

2A

The synthesis of pyrazolidone derivatives M. I. Kabachnik, *J. Gen. Chem.* (U. S. S. R.), 17:18 (1946).  
 $\text{C}_6\text{H}_5\text{CO}_2\text{H}$  is mixed with potash and heated at  $145-170^\circ$  for 2 hrs. with 2,6-diaminopyridine in the presence of a little Cu bronze and KI to give *N*-(*o*-aminophenyl)anthranic acid-HCl, m.  $263-4^\circ$ . The free acid (I) is obtained by suspending the salt in EtOH and neutralizing with  $\text{NH}_4\text{OH}$ . Its sulfate decomps. about  $170^\circ$ . When I is allowed to stand for 1-2 days with concd.  $\text{H}_2\text{SO}_4$  at room temp., it forms *o*-aminopyrazolidone (II), m.  $302-3^\circ$  (rec.), which is unchanged by boiling for 1 hr. with 10% NaOH. Diazotization of II gives *o*-chloropyrazolidone, m.  $373-4^\circ$ . When this is warmed with  $\text{POCl}_3$  and the mixt. poured into ice and  $\text{NH}_4\text{OH}$ ,

it gives 85% of the *diortho* deriv., m.  $249.5-51^\circ$ , of pyrazolidone. If the mixt. is poured into hot  $\text{NH}_4\text{OH}$ , the *ms*-Cl splits off and chloropyrazolidone, m.  $367-8.5^\circ$  (rec.), is formed.  
 H. M. Leicester

Lasin Lab., Inst. of Organic Chem., Acad. Sci., USSR.

ASB-51A METALLURGICAL LITERATURE CLASSIFICATION

PROCESSING AND PROPERTY INDEX

100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200

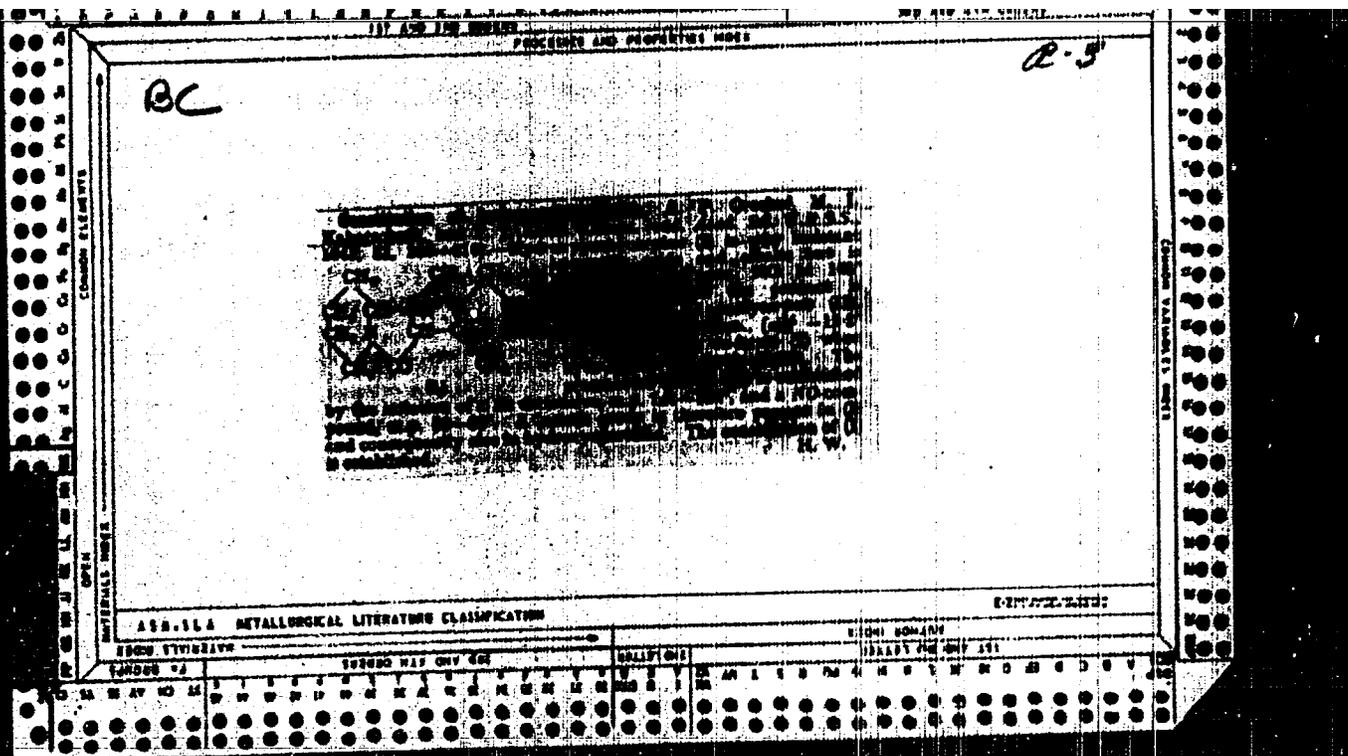
CROSS REFERENCE INDEX

BC
A-3

**Abstracts of Amine Derivatives and their  
and Amine Derivatives**  
 and Amine Derivatives, J. Klotzsch and A. J. Shaw U. Chem.  
 Chem. Rev. 1947, 20, 1997-1999. N-methylamine  
 and MeNH<sub>2</sub> in ethanol (10 hr. at 120-130°) yield a mixture  
 of 2, 3-N,2,6, m.p. 72-73°, and 4,5-derivative, b.p. 100-  
 102°/5 mm. (1947, m.p. 69.5-70.5°) and 6-amino-2,3,4,5-  
 N-methylpyridine, m.p. 91.5-93.5° (lit., m.p.  
 87-88° (lit. (1947); 6-N, m.p. 122-123.5°; 6-N,  
 derivative, m.p. 87-88°; 6-N, m.p. 104-106°; 6-N,  
 derivative, m.p. 143-145°). The toxicity and pharmaco-  
 dynamic activity of the isylamine is < that of amino-  
 methylamine.  
 R. Y.

ASTM DETAILING LITERATURE CLASSIFICATION

| FROM SUBJECT                        |  |  |  |  |  |  |  |  |  |  |  | FROM SUBJECT                        |  |  |  |  |  |  |  |  |  |  |  |
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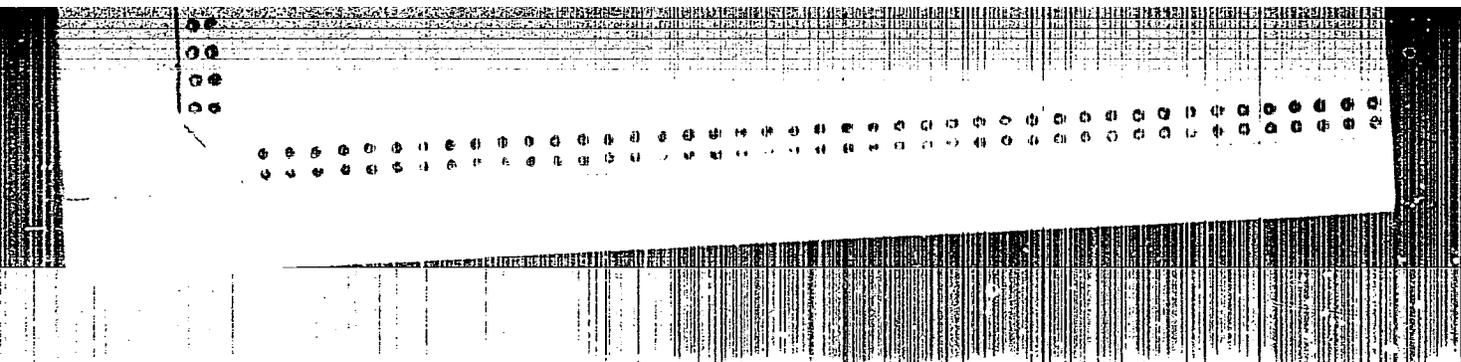


pa

**Esters of a ketophosphonic acids. II. Acid splitting**  
 M. I. Kubachuk and P. A. Kosobukaya (*Dokl. Akad. Nauk SSSR*, **1945**, *Chem. abstr.*, **40**, **4089**). In abs. MeOH, EtOH, PrOH, in the presence of dry HCl. Me esters of the equation  $RCOP(O)(OMe)_2$  + R<sup>2</sup>-OH →  $RCOR^2$  +  $HPO(O)Me_2$  (R = Me, Ph; R<sup>2</sup> = Me, Et, Pr). AcOP(O)(OMe)<sub>2</sub> (0.8 g, 3 ml 1 g abs. MeOH, water bath for 3.5 hrs., yielded 73.5% AcOMe; the fractions b. 54-100°, when redist., gave 2.8 g of a liquid b. 40-52°, d<sub>4</sub><sup>20</sup> 1.029, n<sub>D</sub><sup>20</sup> 1.398, which was identified by its fractionation as  $HPO(O)Me_2$ . AcOP(O)(OMe)<sub>2</sub> (0.9 g) in 2.72 g PrOH with dry HCl, even on heating, no quant. splitting in the absence of HCl, even on heating, no quant. splitting could be obtained. BzPO(O)(OMe)<sub>2</sub> (10.7 g) (I) plus 2.3 g abs. EtOH heated for 2 hrs. at 70°, and fractionated gave 1.5 g  $HPO(O)Me_2$ , about 1 g. BzEt, and 8.3 g. un-  
 changed I. Without HCl and without heating, I formed addn. products with all 3 abs. I (2.1 g.) in 0.32 g. abs. MeOH crystal. spontaneously, after drying the yield was 0.09 g., analysis confirmed the addn. compd.  $Ph(Me)(HOC)(O)COP(O)(OMe)_2$ , m. 73-8°. The crystals decomp. gradually both on standing in a sealed tube and over P<sub>2</sub>O<sub>5</sub>. I (2.1 g.) in 0.10 abs. EtOH kept at -13 to -14° for 20 hrs. gave 1.4 g. prism, m. 61-62°, the loss of wt. after 6 weeks standing (const. wt.) corresponded to the calcd. EtOH in the 1:1 mol. compd. I (1 g.) and 0.3 g. PrOH at -10°C. for 24 hrs. gave 1.2 g. (87%) addn. compd.

m. 81-82°, which decomp. rapidly in a sealed tube. It was demonstrated that the rupture of the P-C bond need not be preceded by hydrolysis of the ester group and formation of free a ketophosphonic acid. The general mechanism appears to be  $RCOP(O)(OR^2)_2 + R^1OH → R^1C(O)R^2 + RCOP(O)(OR^2)_2$ , followed by  $R^1C(O)R^2 + RCOP(O)(OR^2)_2 → RCOR^2 + HPO(O)R^2$  (R = Me, Ph, Et; R<sup>2</sup> = Me, Et; R<sup>1</sup> = H, Me, Et, Pr). N. Thon

INS. 77 ORG., CHEM., Acad. Sci. USSR, 1945



**Esters of  $\alpha$ -keto phosphonic acids. III. Two types of carboxylic acid derivatives.** M. I. Kabachnik, P. A. Kossolitskaya, and E. S. Shepeleva. *Sov. Acad. Sci.*

*U.R.S.S. Classe sci. chim.* 1947, 163-71; cf. *C.A.* 41, 49d. The esters of the type  $RC(O)PO(OR)_{2}$  exhibit a considerable reactivity of the carbonyl group, analogously to that shown by  $\alpha$ -keto carboxylic acids, trichloromethyl ketones, and other substances with an electron-attracting group adjacent to CO. Improvements in yields of the starting materials were made by controlling the temp. of the reaction of acyl chlorides with trialkyl phosphites; thus,  $AcPO(OMe)_{2}$  was obtained in 80% yield when the prepn. was done at 0°, and the Et ester was prepd. in 50% yield at 15°.  $(BuO)_{3}P$  (10 g.) added with cooling to 4 g.  $AcCl$  and allowed to stand overnight gave, on distn., 49.8%  $AcPO(OBu)_{2}$  (I), b.p. 87-8°, d<sub>4</sub><sup>20</sup> 1.0199, n<sub>D</sub><sup>20</sup> 1.4391; phenylhydrazone m. 104-4.5° (from  $CHCl_{3}$  ligroin or Et<sub>2</sub>O).  $BzPO(OMe)_{2}$  (4.2 g.) shaken briefly with an excess of concd.  $NaHSO_{3}$  soln. and filtered gave 88%  $BzC(OH)(SO_{2}Na)PO(OMe)_{2}$  (II), a white cryst. solid which softens at 94° but does not melt, sol. in H<sub>2</sub>O, less sol. in EtOH. The use of the di-Et ester gave the corresponding analog in 64% yield;  $AcPO(OMe)_{2}$  gave 65% of the corresponding deriv. as colorless crystals, sol. in H<sub>2</sub>O, less sol.

in EtOH;  $AcPO(OEt)_{2}$  gave 63% of the adduct having similar properties. I and  $NaHSO_{3}$  gave 59.5% of the adduct, m. 135-6° (with some decolpn.), sol. in H<sub>2</sub>O and EtOH. To 17.5 g. II in 80 cc. H<sub>2</sub>O at 5° was added a concd. aq. soln. of 5 g. KCN; the pptd. oil was taken up in Et<sub>2</sub>O, dried, and distd. to give 84.8%  $PAC(OH)(CN)PO(OMe)_{2}$ , b. 143-3.5°, d<sub>4</sub><sup>20</sup> 1.2346, n<sub>D</sub><sup>20</sup> 1.4880; the same compld. is obtained in 70.8% yield on addn. of KCN to the crude mixt. of the ester and  $NaHSO_{3}$ ; the product dissolves in H<sub>2</sub>SO<sub>4</sub> with a red color, which changes to a yellow ppt. on diln. Hydrolysis, in an attempt to prep. the  $COH$  deriv., by heating with 1:3 HCl in hrs. on a steam bath gave only  $PhC(OH)(CO_{2}H)_{2}$ , as the C-P bond was completely cleaved. Similar reaction of 14.7 g.  $MeC(OH)(SO_{2}Na)PO(OMe)_{2}$  with 3.8 g. KCN in 25 cc. H<sub>2</sub>O gave 52.5%  $MeC(OH)(CN)PO(OMe)_{2}$ , b. 95°, b.p. 113-13.5°, d<sub>4</sub><sup>20</sup> 1.1965, n<sub>D</sub><sup>20</sup> 1.4092; the product 38% if the bisulfite adduct is not isolated; the product does not give a color with H<sub>2</sub>SO<sub>4</sub>. The behavior of the  $\alpha$ -keto phosphonates is contrasted to the carbonyl compds. in which the CO is adjacent to an ortho-para orienting group, i.e.,  $NH_{2}$ , Me; in the latter cases the activity of the CO group is greatly repressed. G. M. Kuzolapoff

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CA

10

Phosphoorganic compounds. VI. Reaction of ethylene oxide with phosphorus tribromide. P. A. Remskhaya and M. I. Katschnik. *Bull. acad. sci. U.R.S.S., Class sci. chim.* 1947, 389-93 (in Russian).—Ethylene oxide (I) reacts with PBr<sub>3</sub> in a manner exactly analogous to the previously reported reaction with PCl<sub>3</sub> (*ibid.* 1946, 305; part V, (947, 233)). This is possible only because of the complete absence of generated HBr, which, in the case of reactions of ROH with PBr<sub>3</sub>, immediately cleaves the intermediate Br<sub>2</sub>POR (or BrP(OR)<sub>2</sub>, etc.) and yields RBr. I reacts with PBr<sub>3</sub> vigorously and, unless cooling is used, yields much yellow P and a complex mixt. of products: PBr<sub>3</sub> (303.2 g.), treated with 51.9 g. I with stirring at -10° to -5°, then allowed to stand overnight and distd., gave 121.2 g. BrCH<sub>2</sub>CH<sub>2</sub>O<sub>2</sub>PBr<sub>2</sub>, b<sub>p</sub> 79-80°, d<sub>4</sub><sup>20</sup> 2.3780, n<sub>D</sub><sup>20</sup> 2.3753, n<sub>D</sub><sup>15</sup> 1.8106, and 10.4 g. (BrCH<sub>2</sub>CH<sub>2</sub>O)<sub>2</sub>PBr, b<sub>p</sub> 116-19°, d<sub>4</sub><sup>20</sup> 2.1133, d<sub>4</sub><sup>15</sup> 2.1100, n<sub>D</sub><sup>20</sup> 1.8071, which changes on repeated distn. (see the Cl analog). When 57.2 g. PBr<sub>3</sub> was treated with 33.4 g. I at -15° to -12°, allowed to stand overnight and heated 3 hrs. on a steam bath to expel the excess I, it was found impossible to distill the resulting (BrCH<sub>2</sub>CH<sub>2</sub>O)<sub>2</sub>P because of the ensuing isomerization reaction. Hence, the product was isomerized directly by heating to 120° 3 hrs., then to 180° 2 hrs. On cooling the mass crystall., on seeding with the Cl analog, to give 20.8 g. (BrCH<sub>2</sub>CH<sub>2</sub>O)<sub>2</sub>P(=O)CH<sub>2</sub>CH<sub>2</sub>Br, m. 48-9° (from petr. ether). This (10 g.) and 10.4 g. PCl<sub>3</sub>, heated in a sealed tube 4 hrs. at 140-5°, gave Cl-CH<sub>2</sub>CH<sub>2</sub>Br and 31.5% BrCH<sub>2</sub>CH<sub>2</sub>P(=O)Cl<sub>2</sub>, b<sub>p</sub> 119-20°, d<sub>4</sub><sup>20</sup> 1.8202, d<sub>4</sub><sup>15</sup> 1.8142, n<sub>D</sub><sup>20</sup> 1.8210. This (1.38 g.),

added slowly to water, the soln. evapd., and the residue crystall. alternately from benzene and CCl<sub>4</sub>, CH<sub>2</sub>Cl<sub>2</sub>, gave 0.45 g. BrCH<sub>2</sub>CH<sub>2</sub>P(=O)(OH)<sub>2</sub>, m. 86-7°, sol. in H<sub>2</sub>O, HCl, and CHCl<sub>3</sub>, poorly sol. in benzene, insol. in petr. ether. The dichloride with 4 mols PhNH<sub>2</sub> in benzene gave the diamide, m. 160-70° (from nq. HCl and CHCl<sub>3</sub>).  
G. M. Kosolapoff

A 50-11-A METALLURGICAL LITERATURE CLASSIFICATION

CA

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Phosphogenic compounds. VII. Reaction of glycol with phosphorus trichloride and with Menabedian's acid chlorides. A. Kwasitkays and M. I. Kabachnik. *Bull. Acad. Sci. U.R.S.S. Chem. Ser.* 1957, 500-14; in conflict with those of Carré (*Compt. Rend.* 136, 756 (1903)). Cf. C. A. 42, 1538d. — Observations were made which are in conflict with those of Carré (*Compt. Rend.* 3) 27, 204 (1902)). To 500 g. PCl<sub>3</sub> there was added with stirring and ice-cooling 62 g. (CH<sub>2</sub>O), the mixt. stirred 1.5 hr., heated 3 hrs. to 60-70°, and distd., gave (besides 21.3 g. C<sub>2</sub>H<sub>4</sub> and PCl<sub>3</sub>) after repeated fractionation: 71.3 g. C<sub>2</sub>H<sub>4</sub> (b.p. 66-67°, n<sub>D</sub><sup>20</sup> 1.4894, d<sub>4</sub><sup>20</sup> 1.4229, d<sub>4</sub><sup>25</sup> 1.4189 (colorless liquid, fuming in air, vigorously reactive with H<sub>2</sub>O, and violently oxidizable by HNO<sub>3</sub>), and 21.1 g. crude (unspecified am. of pure) C<sub>2</sub>H<sub>4</sub>Cl<sub>2</sub> (b.p. 83-100°, pure product b.p. 84-5°, d<sub>4</sub><sup>20</sup> 1.4688, n<sub>D</sub><sup>20</sup> 1.4133, n<sub>D</sub><sup>25</sup> 1.4098). In contrast to Carré, no CCl<sub>4</sub> or CH<sub>2</sub>Cl<sub>2</sub> was observed. The C<sub>2</sub>H<sub>4</sub> at -15° to -18° (b.p. 84 g.) was treated with 3.05 g. Cl<sub>2</sub> and the product after which the excess Cl<sub>2</sub> was blown off and the product (15.5 g.), 74.5 g. Et<sub>3</sub>NPh, and 60 cc. Et<sub>2</sub>O, treated with vigorous stirring with 23.3 g. MgOPCl<sub>2</sub> and stirred for 2 hrs., gave after filtration and distn. of the filtrate 8.1 g. MgOPCl<sub>2</sub> (b.p. 60-3°, d<sub>4</sub><sup>20</sup> 1.2057, d<sub>4</sub><sup>25</sup> 1.2044, n<sub>D</sub><sup>20</sup> 1.4448, a colorless liquid smelling like (MeO)P. A similar reaction using Et<sub>2</sub>O gave a low yield of the pure EtO analog, b.p. 61-2.5°, d<sub>4</sub><sup>20</sup> 1.1191, n<sub>D</sub><sup>20</sup> 1.4207. Adding of 3.3 g. Cl<sub>2</sub> to 5.8 g. of the MeO compd. with ice-cooling gave 1.4 g. C<sub>2</sub>H<sub>4</sub>Cl<sub>2</sub>(OMe)Cl, b.p. 88.5°, d<sub>4</sub><sup>20</sup> 1.4163, n<sub>D</sub><sup>20</sup> 1.4133, n<sub>D</sub><sup>25</sup> 1.4088, slowly hydrolyzable by water; no EtCl formation was observed, showing that the Arbusov rearrangement occurred preferentially with the cyclic ester structure. Similar treatment of the crude EtO deriv. gave impure C<sub>2</sub>H<sub>4</sub>Cl<sub>2</sub>(OEt)Cl, b.p. 115-7°, n<sub>D</sub><sup>20</sup> 1.4194, n<sub>D</sub><sup>25</sup> 1.4126. G. M. Scaletoff

ASS-35A METALLURGICAL LITERATURE CLASSIFICATION

KABACHNIK M. L.  
CA

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Phosphorganic compounds. IV. Derivatives of 2-chloroethanephosphonic acid. M. I. Kabachnik, P. A. Rosnitskaya, and N. N. Novikova—*Sov. Acad. Sci. U.R.S.S., Classe sci. chim.* 1947, 97-100 (in Russian); *C. A. 42*, 2024b.—Dry EtOH (13.8 g.), 23.4 g. pyridine, and 120 cc. Et<sub>2</sub>O, treated with cooling and stirring with 27 g. CCl<sub>3</sub>CH<sub>2</sub>POCl<sub>2</sub> (I) in Et<sub>2</sub>O, let stand overnight, and filtered, gave 18 g. CCl<sub>3</sub>CH<sub>2</sub>PO(OEt)<sub>2</sub>, b<sub>1</sub> 92-4°, d<sub>4</sub><sup>20</sup> 1.1568, d<sub>4</sub><sup>25</sup> 1.1558, n<sub>D</sub><sup>20</sup> 1.4390. Similarly, 18.2 g. CCl<sub>3</sub>CH<sub>2</sub>POCl<sub>2</sub>, 6.4 g. MeOH, 30 g. Et<sub>3</sub>NPh in Et<sub>2</sub>O gave the di-Me ester, b<sub>1</sub> 65-7°, d<sub>4</sub><sup>20</sup> 1.2666, n<sub>D</sub><sup>20</sup> 1.4490 (3.7 g.). I (2.7 g.), heated with 4.3 g. PhOH to 120-30° 3 hrs. and 1 hr. to 160-60° yielded 2.9 g. di-Ph ester, b<sub>1</sub> 176-8.5°, d<sub>4</sub><sup>20</sup> 1.2071, d<sub>4</sub><sup>25</sup> 1.2043, n<sub>D</sub><sup>20</sup> 1.5577. I (18 g.) and 12 g. pyrocatechol heated 1 hr. to 130-40° gave 19.7 g. CCl<sub>3</sub>CH<sub>2</sub>PO(O<sub>2</sub>C<sub>6</sub>H<sub>3</sub>)<sub>2</sub>, b<sub>1</sub> 167-70°, d<sub>4</sub><sup>20</sup> 1.4026, d<sub>4</sub><sup>25</sup> 1.4015, n<sub>D</sub><sup>20</sup> 1.5502 (the material before distn. is a cryst. solid dipyrocatechyl ester, which cyclizes on distn.). I (18 g.) and 12 g. pyrocatechol, heated 1 hr. to 140°, cooled, and seeded, gave a cryst. solid, which, after treat-

ment with charcoal in benzene soln. and pptn. by an equal vol. of petr. ether, gave an oil which was discarded; the supernatant soln. on evapn. gave CCl<sub>3</sub>CH<sub>2</sub>PO(OCCl<sub>3</sub>OH)<sub>2</sub>, m. 100-3°, deliquescent in air. I (0.9 g.) was mixed in benzene soln. with 1.9 g. PhNH<sub>2</sub>, and after 4 hrs. standing the mixt. was filtered and washed with hot benzene; evapn. of the filtrate gave 60% CCl<sub>3</sub>CH<sub>2</sub>PO(NHPh)<sub>2</sub>, m. 169-70° (from dil. EtOH). V. Esters of ethylenephosphonic acid. M. I. Kabachnik. *Ibid.* 233-4.—CCl<sub>3</sub>CH<sub>2</sub>PO(OEt)<sub>2</sub> (17.6 g.) was added to 4.9 g. KOH in EtOH; heat was generated and KCl pptn. began; after heating 1 hr. on a steam bath the mixt. was filtered to give, after 3 distns., 6.1 g. pure CH<sub>2</sub>=CHPO(OEt)<sub>2</sub>, b<sub>1</sub> 68-70°, d<sub>4</sub><sup>20</sup> 1.0820, n<sub>D</sub><sup>20</sup> 1.4301. This (2.6 g.) treated with 2.6 g. Br in 15 cc. CCl<sub>4</sub>, allowed to stand overnight, and distd., gave 2.1 g. BrCH<sub>2</sub>CHBrPO(OEt)<sub>2</sub>, b<sub>1</sub> 129-31.5°, d<sub>4</sub><sup>20</sup> 1.6181, d<sub>4</sub><sup>25</sup> 1.6160, n<sub>D</sub><sup>20</sup> 1.4939. CCl<sub>3</sub>CH<sub>2</sub>PO(OCCl<sub>3</sub>CH<sub>2</sub>Cl)<sub>2</sub> (27 g.) with 6 g. KOH as above gave CH<sub>2</sub>=CHPO(OCCl<sub>3</sub>CH<sub>2</sub>Cl)<sub>2</sub>, b<sub>1</sub> 137-9°, d<sub>4</sub><sup>20</sup> 1.3212, d<sub>4</sub><sup>25</sup> 1.3182, n<sub>D</sub><sup>20</sup> 1.4772. The vinyl compounds on heating with 2-3% H<sub>2</sub>O<sub>2</sub> polymerize to viscous resinous products.  
G. M. Kosolapov

ASD-31A METALLURGICAL LITERATURE CLASSIFICATION

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KABACHNIK, M. I.

PA 8T13

USSR/Chemistry - Ethers  
Alpha - Ketophosphinic acids

Feb 1947

"Ethers of Alpha-Ketophosphinic Acids," M. I.  
Kabachnik, P. A. Rossiyskaya, F. S. Shepeleva, 8 pp

"Izv Ak Nauk Khim" No 2

Study of the two types of derivatives of carboxylic  
acids.

*Bull Acad. Sci. URSS, CLASS CHIM.*

BT13

KABACHNIK, M. I.

Sep/Oct 1947

USSR/Chemistry - Phosphorus  
Chemistry - Organic Compounds

"Investigations in the Field of Phosphoorganic Compounds, VII," I. A. Rossiyskaya,  
M. I. Kabachnik, Inst Org Chem, Acad Sci USSR, 6 1F

"Izv Akad Nauk SSSR, Otd Khim Nauk" No 5

Studies reaction of glycol with trichloride of phosphorous and Menshutkin's acid  
chlorides, and shows that cyclic glycol esters are formed during reaction.

PA 53T4

*Inst. of Org. Chem., Acad. Sci., USSR.*

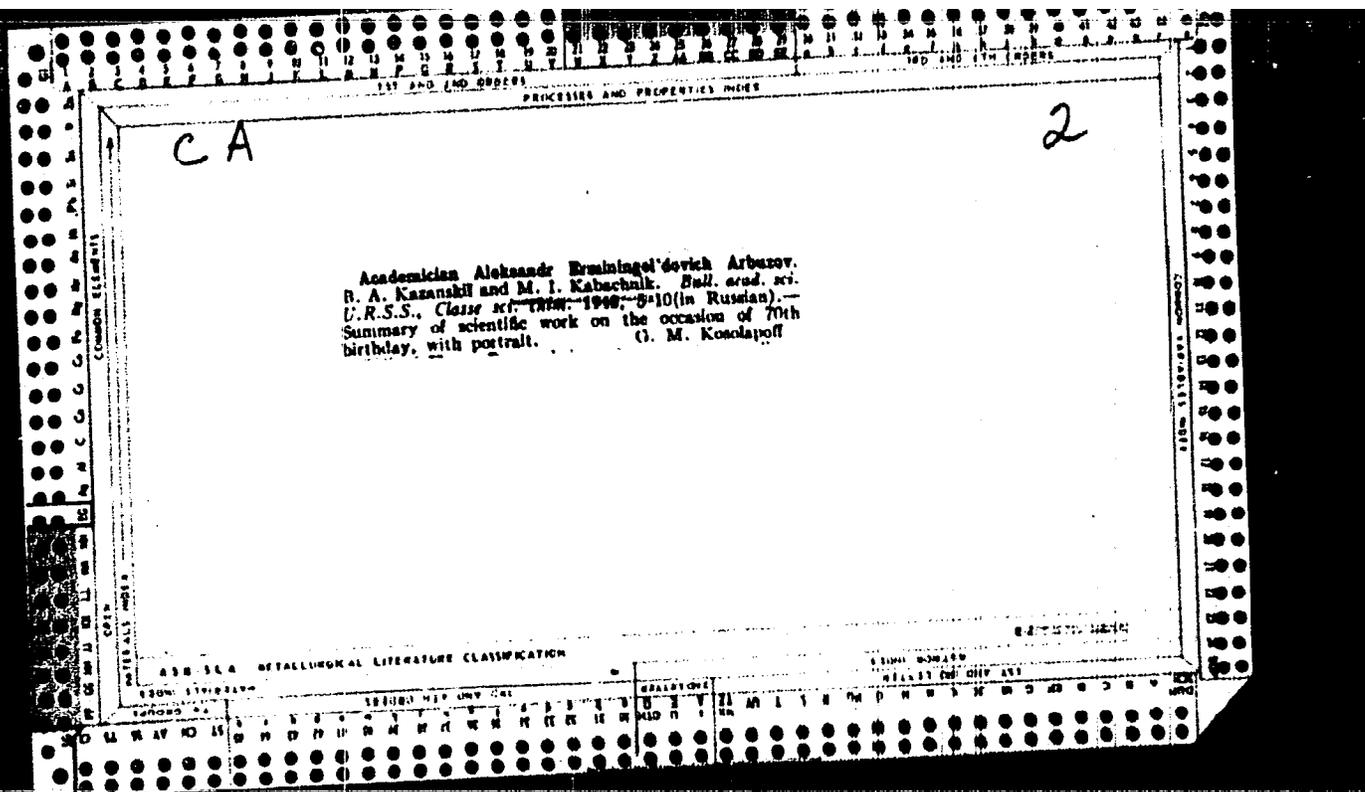
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Phosphororganic compounds. VIII. Mixed 2-chloro-ethyl aryl esters of phosphorous acid. M. I. Kubachnik, *Dokl. Akad. Nauk S.S.S.R.*, 1947, 181: 8; *Chem. Abstr.*, 42: 2621b, 11336d. (PhO)<sub>2</sub>PCl (87 g.) was treated with ethylene oxide (I) at 10-15° until slightly over 1 mole was taken up; the mixt. was warmed on a steam bath to expel excess I, after which distn. in a CO<sub>2</sub> stream gave 6.2 g. (PhO)<sub>2</sub>POCH<sub>2</sub>CH<sub>2</sub>Cl (II), b<sub>p</sub> 163-4°, d<sub>4</sub><sup>20</sup> 1.2317, n<sub>D</sub><sup>20</sup> 1.5584. Standing of II in water 2 days leads to complete hydrolysis to H<sub>3</sub>PO<sub>3</sub>. II (3.6 g.) heated 3.5 hrs. to 250° (in a distn. flask) gave some ClCH<sub>2</sub>CH<sub>2</sub>Cl and 2.1 g. (PhO)<sub>2</sub>P(O)(CH<sub>2</sub>CH<sub>2</sub>PO(OPh)<sub>2</sub>), m. 160-5.5° (from PhMe), stable to warm dil. HCl and NaOH; 0.5 g. of this ester heated with 10 ml. 1:1 HCl 8 hrs. to 130°, then briefly to 145° in a sealed tube, gave, after extr. with Et<sub>2</sub>O and evapn. of the aq. layer, 80% (CH<sub>2</sub>PO<sub>2</sub>H)<sub>2</sub> m. 220-1° (from EtOH-Et<sub>2</sub>O), sol. in H<sub>2</sub>O, EtOH, slightly sol. in Me<sub>2</sub>CO, insol. in CH<sub>2</sub>Cl<sub>2</sub>, petr. ether, and benzene; the acid cannot be titrated directly with phenolphthalein because of indistinct endpoints, but on addn. of 6-7 g. NaCl to 50 ml. of aq. soln. at 0°, it titrates well as a tetrabasic acid. (PhO)<sub>2</sub>PCl, (50 g.) was treated with I, as above, until 15 g. was taken up; after warming on a steam bath the product was distd. *in vacuo*, giving 6.7 g. PhOP(OCH<sub>2</sub>CH<sub>2</sub>Cl), b<sub>p</sub> 146-52°, redistn. gave a purer product, b<sub>p</sub> 150-2°, d<sub>4</sub><sup>20</sup> 1.2654, n<sub>D</sub><sup>20</sup> 1.5370, which readily hydrolyzes completely on standing in water; considerable amts. of lower-boiling phosphite esters, which were not investigated, were also obtained. *o*-Phenylene chlorophosphite, b<sub>p</sub> 71-2°, was prepd. in 86% yield from catechol

and PCl<sub>3</sub> according to Arbanov and Valitova (C.A. 35, 3000). This (44.5 g.) was treated with I at 10-20° until heat evolution stopped, after standing overnight, the excess I was expelled by warming and the product distd. *in vacuo* to give 10% 1,2-(CH<sub>2</sub>PO<sub>2</sub>H)<sub>2</sub>CH<sub>2</sub>Cl, b<sub>p</sub> 115-117°, d<sub>4</sub><sup>20</sup> 1.2155, n<sub>D</sub><sup>20</sup> 1.5101, a liquid which rapidly hydrolyzes in moist air; addn. of CaCl<sub>2</sub> gives the equimol. adduct, m. 135-7°. When the ester (35 g.) was heated in a sealed tube 5 hrs. to 200°, much HCl was generated and, on cooling, the product crystal.; distn. *in vacuo* gave 20.5 g. very viscous oil, b<sub>p</sub> 206-80°, which crystal. on warming and gradual cooling (a glass forms on rapid cooling); on redistn. it b<sub>p</sub> 205°. The product melts very unsharply about 190° and the m.p. could not be improved by crystal. while treatment with the usual solvents obviously altered the product. Analysis and behavior of the product indicated its structure is 1,2-(CH<sub>2</sub>PO<sub>2</sub>H)<sub>2</sub> which was confirmed by hydrolysis with 1:1 HCl in H<sub>2</sub>O to remove catechol and evapn. of the aq. soln. to give Et<sub>2</sub>O (CH<sub>2</sub>PO<sub>2</sub>H)<sub>2</sub>, m. 220-1° (from EtOH-Et<sub>2</sub>O). A slight feverin in the distn. of the above ester crystal. on cooling and was identified as pyrocatechol, m. 105-6°, not a trace of the expected pyrocatechol 2-chloroethane phosphonate was found. The results indicate that aryl chlorophosphites react with I normally, giving 2-chloroethyl phosphite deriva.; the latter, however, do not react by a normal Arbanov reaction, but form esters of ethylenediphosphonic acid. The mechanism of this reaction is obscure as the results may be explained either by

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the normal isomerization, followed by reaction of the chloroethane phosphite resulting from the isomerization with unreacted phosphite ester, or by a triphos. reaction with unreacted phosphite ester with  $\text{ClCH}_2\text{CH}_2\text{Cl}$  (which usually is found in isomerization mixts. of  $\text{ClCH}_2\text{CH}_2\text{Cl}$  phosphites). IX. Mixed 2-chloroethyl 2-chloroethyl phosphoric acid. M. I. Kabachnik and ethyl esters of phosphoric acid. *Ibid.* 1948, 95-9 (in Russian). P. A. Rosmitakaya. *Ibid.* 1948, 95-9 (in Russian).  $\text{ClCH}_2\text{CH}_2\text{OPCl}_2$  (31 g.) in 20 ml.  $\text{EtOH}$  and 27 g. pyridine stirring and cooling to 15-18°;  $\text{EtOH}$  and 27 g. pyridine in 100 ml.  $\text{Et}_2\text{O}$ , let stand overnight, sep. from the pyridine-HCl, and fractionated, gave: 5.1 g.  $(\text{EtO})_2\text{P}(\text{Cl})_2$ ,  $n_D^{20}$  1.4170,  $d_4^{20}$  1.1025,  $n_D^{25}$  1.4091,  $d_4^{25}$  1.0982,  $d_4^{20}$  1.1082,  $d_4^{25}$  1.0982,  $n_D^{20}$  1.4292,  $d_4^{20}$  1.1254,  $n_D^{25}$  1.4017,  $d_4^{25}$  1.1113,  $n_D^{20}$  1.4292,  $d_4^{20}$  1.1254,  $n_D^{25}$  1.4017,  $d_4^{25}$  1.1113. Apparently an extensive disproportionation of the alkyl radicals takes place during the reaction. In respect it differs from  $\text{P}(\text{OCH}_2\text{CH}_2\text{Cl})_3$ . Isomerization does occur on heating 3.5 hrs. to 175-180°. 4.0 g. I gave 1.16 g.  $\text{ClCH}_2\text{CH}_2\text{PO}(\text{OEt})_2$ ,  $b_p$  102-7°.  $d_4^{20}$  1.1512,  $d_4^{25}$  1.1490,  $n_D^{20}$  1.4305, identical with the product obtained earlier from  $\text{ClCH}_2\text{CH}_2\text{POCl}_2$  (C.A. 42, 4132) in that hydrolysis with 1:1 HCl 2 hrs. at 140° gave  $\text{ClCH}_2\text{CH}_2\text{PO}_2\text{H}$ ,  $m_p$  74-5°; the ester contained traces of the unisomerized I, as seen from a slight deviation of the phys. constn. from those of the pure substance. G. M. K.



KABACHNIK, M. I.

PA 66T31

USSR/Chemistry - Phosphorous Acid,      Jan/Feb 1948  
Ethers of  
Chemistry - Organic Compounds

"Investigation in the Field of Phosphororganic Compounds, Part IX: The Miscellaneous  $\beta$ -Chloroethyl-ethyl Ethers of Phosphorous Acid," M. I. Kabachnik, P. A. Rossiyskaya, Inst of Org Chem, Acad Sci USSR, 5 pp

"Iz Ak Nauk SSSR, Otdel Khim Nauk" No 1

Detailed description of how to obtain  $\beta$ -chloroethyl-ethyl ethers of phosphorous acid, and of the isomerization during heating.

66T31

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Phosphoric compounds. X. Atomic refraction of phosphorus in esters and chlorides of acids of phosphorus. M. A. Kozlovskii. *Bull. acad. sci. U.R.S.S., Classe sci. chim.* 1968, 219-27 (in Russian); cf. *C.A. Class. sci. Chem.* 1968, 5845. — An extensive review of literature is presented with 17 references, in which the most probable values of at. refraction of P are examined. For Na<sub>2</sub>S<sub>2</sub>O<sub>8</sub> the following values appear to be most sound: 7.04 for P(OR)<sub>3</sub>, ROPCl<sub>2</sub> and (RO)<sub>2</sub>PCl; 3.75 for (RO)<sub>2</sub>P(OR) and ROP(O)Cl<sub>2</sub>; 4.37 for esters or chlorides of phosphonic or phosphinic acids. The value of O in the P:O grouping should be 2.311, and values for halogens in P—X linking should be those used for acyl halides. G. M. Kozlovskii

INST. ORG. CHEM., ACAD. SCI. USSR.

ADD-31A METALLURGICAL LITERATURE CLASSIFICATION

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KABACHNIK, M. I.

USSR/Chemistry - Organic Compounds Mar/Apr 1948  
Chemistry - Phosphorescent Substances

"Studies in the Field of Phosphorous Organic Com-  
pounds," M. I. Kabachnik, Inst Org Chem, Acad Sci,  
9 pp

"Izvest Akad Nauk SSSR, Otd Khim Nauk" No 2

Number ten in a series of articles. Discusses  
atomic refraction of phosphorus in esters and haloid  
anhydride acids of phosphorous acid. Critical re-  
view of size of atomic constant of phosphorous re-  
fraction, as determined by various authors. Estab-  
lishment of most useful constant which can be applied  
to a major part of phosphorous organic series com-  
pounds. Submitted 25 Dec 1945.

63712

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

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Orientation in the benzene ring. M. I. Kabachnik.  
*Uspekhi Khim.* 17, 90-131(1948). Review with 58  
 G. M. Kosolupoff  
 references.

Describes experimental data, hypotheses and theories, discussion  
 on resonance theory, electron displacement theory, distribution of electrons  
 in plane of benzene ring and distribution of electrons in plane of benzene  
 ring at moment that a reaction is taking place. 7LTS

ASB 514 METALLURGICAL LITERATURE CLASSIFICATION

67T24

USSR/Chemistry - Esters, Sulfur Compounds May 1948

Chemistry - Alkyl Group

"Research on the Reaction of Phosphorous Thio Esters With Haloid Alkyls and Acyls," A.F. Dvinskii, M.I. Kabanik, V.V. Sidorenko, 4 pp

"Dokl Ak Nauk SSSR, Nov Ser" Vol IX, No 6

Tabulates results of experiments. Data obtained established that it is entirely possible to carry out the reaction of thio esters with acids. trivalent phosphors with haloid alkyls and acyls. This reaction can be traced by means of Arbusov's

USSR/Chemistry - Esters, Sulfur Compounds May 1948 of (Contd)

theory of regrouping, and by the method of observing the atom of divalent sulfur. Submitted by Academician A.N. Nesmeyanov 18 Mar 1948.

KABACHNIK, M. I.

67T24

Alexander Nikolaevich Nesmeyanov. R. Kh. Preid-  
lina, M. L. Kabachnik, and V. V. Korshak. *Izvest.*  
*Acad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1949, No. 6. --  
A review of his scientific work on his 50th birthday.  
G. M. Kimbatov

KABACHNIK, M. I.

USSR/Chemistry - Magnesium Compounds,  
Organic

Jan/Feb 49

Chemistry - Synthesis

Study in the field of Phosphor Organic Compounds

II. Case of Anomalous Course of the Synthesis of

Magnesium Organic Compounds, M. I. Kabachnik, Ye. S. Serepova, Inst Org Chem, Acad Sci USSR, 4 pp

No 1

"Tr Ak Nauk SSSR, Otdel Khim Nauk"

Gives anomalous reaction of haloid compound of phosphor (PCl<sub>3</sub>) with methyl iodide of magnesium. Basic product of the reaction is a sulfide, i.e., a substance completely methylated diphosphyl, i.e., a molecule containing two atoms of phosphor in the molecule.

07/10/1949

Jan/Feb 49

USSR/Chemistry - Magnesium Compounds,  
Organic (Contd.)

Good yield of dimethylphosphinic acid is obtained by the oxidation of this sulfide. Submitted 3 Mar 48.

27/149125

CA

Reaction of benzaldehyde with phosphorus trichloride  
 M. I. Kabachnik and E. S. Shepeleva (Acad. Sci. U.S.S.R., Moscow). *Izv. Akad. Nauk S.S.S.R., Otdel Khim. Nauk* 1950, 39-40. The mode of interaction of aldehydes with  $PCl_3$ , which has not been adequately explained by the earlier work of Fieser (*Monatsh* 5, 627 (1884)), Page (C. I. 6, 200), or Comant, *et al.* (C. I. 16, 60), appears to involve the preliminary formation of a trivalent P deriv., rather than a "pentavalent" one usually ascribed to the 1st reaction stage. Thus, Bell first forms  $(PhCHClO)_3P$  which on heating undergoes the Arburv isomerization into the chlorophosphonate. In this case, the reposition of Cl makes possible a reum- temp. isomerization. The theory conforms to the known difficult alkylation of  $PCl_3$  and to the known reaction of 1 moles of an aldehyde with  $PCl_3$ . Mixing 41.2 g.  $PCl_3$  with 30 g. Benz (both freshly distd.) with cooling, fol- lowed by heating in sealed tubes 2 hrs. at 105-205°, gave a viscous product, most of which by 121-0°, m. 60-1° (55%). Excess  $PCl_3$  gave a 62% yield. The residue is a glass, the amt. of which rises with lower temps. The main product is  $PhCH(O)P(O)Cl_2$ , resulting from the action of  $PCl_3$  on the corresponding phosphonate. Re- action of Benz and  $PCl_3$  in a 1:1 ratio in the cold yields a pink oil which cannot be distd. and yields on hydrolysis 2 mols. of Benz and  $PhCH(OH)PO(OH)_2$ . 1 (15 g.) at- mols. of Benz and  $PhCH(OH)PO(OH)_2$  gave on distn- lowed to stand 1-2 days in 48 g. abs. EtOH gave on distn- at atm. pressure, then in vacuo, 71%  $PhCH(O)P(O)Cl_2$ , b.p. 128-0°, d<sub>4</sub> 1.020, n<sub>D</sub> 1.5125, the same is

obtained in 45% yield when a crude mixt. of 7.5 g. Benz and 10.3 g.  $PCl_3$  is heated 2 hrs. at 105-205°, then treated with EtOH. 1.8 g. with 25 g. MeOH similarly gave 52%  $PhCH(O)P(O)Cl_2$ , b.p. 127-0°, d<sub>4</sub> 1.0311, n<sub>D</sub> 1.5288. Heating 1 g. I with 3.25 g. PhOH 6.5 hrs. progressively from 125° to 250° gave much residue and 2 g.  $PhCH(O)P(O)Cl_2$ , b.p. 121-0°, d<sub>4</sub> 1.0288. Allowing I to stand in  $H_2O$  until dissolved, followed by evapn. or racke at 45-40°, gave 60%  $PhCH(O)P(O)Cl_2$ , m. 133-4° from MePh, then  $Me_2CO-C_6H_6$ ; the same result occurs after 10 days exposure of I to atm. moisture (100% yield); the use of boiling  $H_2O$  for hydrolysis gives the solid of low m.p., which rises to 130° only after many crystals, with con- siderable Cl ion being found in the sup. soln. The Cl acid with  $Ag_2CO_3$  ppt. the di-Ag salt, sol. in  $H_2O$ , and in ex- cess of aq. soln. of the Cl acid, boiling the soln. yields  $AgCl$ .  $PhCH(O)P(O)Cl_2$ , 2.50 g. and 2.01 g.  $Ag_2CO_3$  in  $H_2O$  soln., refluxed until the original Ag salt has gradually been transformed into  $AgCl$ , gave 1.78 g.  $AgCl$  (100%) and the Ag free soln. on evapn. gave  $PhCH(O)P(O)Cl_2$ , m. 127-0°. This 10.3 g. gave  $PhCH(O)P(O)Cl_2$  and 1.60 with 0.5 g.  $PhNH_2$  gave in 0.5 ml. EtOH and 1 ml.  $H_2O$  with 0.5 g.  $PhNH_2$  gave the anion salt, m. 280-2°. Addn. of excess  $PhNH_2$  to 4 g. I in EtOH, removal of the  $PhNH_2 \cdot HCl$  by evapn. taking up in EtOH, and pptn. with dil. HCl, gave 2 g.  $PhCH(O)P(O)Cl_2$ , m. 102-4° from dil. EtOH, then from MeOH. G. M. Kosolapoff

KABACHNIK, M. I.

KABACHNIK, M. I.

Organophosphorus compounds. XIV. Synthesis of aryl-  
~~amino acid esters~~. I. M. I. Kabachnik and E. Ya. Medved. *Izv. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1950, 135-40; cf. *C.A.* 43, 5739c; 44, 7257f. Heating  $(EtO)_2P$  with  $CH_3I$ , 6-7 hrs. with continuous removal of  $EtI$  in a stream of dry air, gave 30-40%  $ICH_2P(O)(OH)_2$ , b<sub>p</sub> 110-20°, *n*<sub>D</sub><sup>20</sup> 1.5000, *d*<sub>4</sub><sup>20</sup> 1.3300. This (1.65 g.) kept 8 days at room temp. with 10 ml. 25%  $NH_4OH$ , then cooled, in *vacuo*, gave an oil and a solid, which on extr. with  $Et_2O$  gave an unstated amt. of unreacted ester, b<sub>p</sub> 111-12°; the  $Et_2O$ -insol. crystals, m. 108° (from abs.  $EtOH-C_6H_6$ ), were shown to be  $ICH_2P(O)(OEt)ONH_2$ ; the product is sol. in  $H_2O$  and  $EtOH$ , insol. in  $Et_2O$ ,  $CHCl_3$ , and  $C_6H_6$ ; it does not ppt.  $AgI$  in an acid soln. of  $AgNO_3$ ; its aq. soln. is neutral to litmus. The yield is 3.2%; in an 80-day reaction this rises only to 15.8%. Reaction in moist liquid  $NH_3$ , 10 days at room temp. in a sealed tube gave similar results. When, however, the ester (50 g.) was heated in sealed tubes 10 hrs. to 100° with 50 ml. 25%  $NH_4OH$ , evapd. to const. wt. on a water bath, and the sirupy residue dild. with a little  $H_2O$ , shaken with 30 g. fresh  $Ag_2O$ , filtered, treated with  $H_2S$ , filtered, concd. on a water bath, dild. with 1 vol. abs.  $EtOH$ , and treated with alc.  $PhNH_2$  until pptn. was complete, there was obtained 6.7 g. (25%)  $H_2NCH_2P(O)(OEt)OH$ , m. 240° (from  $EtOH$ ), sol. in  $H_2O$  and hot  $EtOH$ , insol. in the usual org. solvents. Heating 3 g. of this product with 50 ml. concd.  $HCl$  in a sealed tube 3 hrs. at 120-40°, evapd., dild. with a little  $H_2O$ , and pptn. with  $EtOH$  gave 2.25 g. (9.2%)  $H_2NCH_2P(O)(OH)_2$ , m. 310° (from dil.  $EtOH$ ), sol. in  $H_2O$ , poorly sol. even in hot  $EtOH$ . Since its 1st and

2nd dissociation constants are widely different, titrations with phenolphthalein and with alizarin red may be used. A simpler prepn. is also given. Dry paraform (sublimes at 145-55°) (200 g.) in a 2-l. autoclave was treated slowly with 1320 g.  $PCl_5$ , then heated 5 hrs. to 220-50° (pressure about 30 atm.); distn. gave 500-510 g.  $(C_6H_5)_2POCl_2$  (50%), b<sub>p</sub> 91°, *n*<sub>D</sub><sup>20</sup> 1.4083; this (50 g.) was slowly added at 2° to 154 ml. abs.  $EtOH$ , let stand overnight, and chdld., yielding 40 g. (72%)  $(C_6H_5)_2P(O)(OEt)_2$ , b<sub>p</sub> 88-90°, *n*<sub>D</sub><sup>20</sup> 1.4112, *d*<sub>4</sub><sup>20</sup> 1.1060. Heating this (22 g.) with 50 ml. 25%  $NH_4OH$  10 hrs. to 100° in a sealed tube, evapd., and treatment with 23 g.  $Ag_2O$  as described above gave 4 g. (21%)  $H_2NCH_2P(O)(OH)_2$  (crude) 80° and (after prolonged drying) 55-7°. Heating 0.75 g. amino acid with 1.5 g.  $H_2C_2O_4$  3 hrs. to 165-75° in a sealed tube, sept. of the upper powdery layer from the lower glassy layer, and washing the former with  $Et_2O$  gave some  $BzOH$  from the  $H_2O$  ext. Pptn. of the glassy material from a little hot  $H_2O$  with  $EtOH$  gave 0.45 g. unreacted amino acid. The  $Et_2O$ -insol. powder (0.1 g.) was  $BzNHCH_2P(O)(OH)_2$ , softening at 105°, decomp. 185-6° (from  $EtOH-PhCl$ ).  
 G. M. Kosolapoff

KABACHNIK, M.I., KURSANOV, D.N., KAVERZNEVA, Ye.D., PRILEZHAYEVA, Ye.N., SOKOLOV, N.D.  
and FREYDLINA, R. Kh.

"The Current State of Chemical Structure," Usp. Khim., 19, No.5,  
pp 529-544, 1950

Translation W-16104, 30 Dec 50

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Reaction of aldehydes with halogen derivatives of tri-valent phosphorus. M. I. Kabachnik and E. S. Shepeleva. *Doklady Akad. Nauk S.S.S.R.* 75, 219-22 (1950); cf. *C.A.* 44, 7257. The formation of 1-halo-phosphonyl dichlorides by high-temp. reaction of  $PCl_3$  with aldehydes and ketones is a general reaction, with few exceptions. The yields vary with the nature of the carbonyl compd. and

with the halide used. Aliphatic aldehydes yield much  $HCl$  and give poor results, possibly because of a proton-type substitution brought about by  $PCl_3$  as a water-retaining substance. Chloral could not be made to react even under very drastic conditions (5 hrs. at  $270^\circ$ ). Aromatic aldehydes react well, but  $p-Me_2NC_6H_4CHO$  yields so much tar that no clean product was isolated.  $m-O_2NC_6H_4CHO$  gives little of the desired product and causes considerable oxidation of the  $PCl_3$ , yielding colored reduction products of the aldehyde.  $o-HOC_6H_4CHO$  yields much  $HCl$  and after 2.5 hrs. at  $185-200^\circ$  gives a tarry mass which on distil-

readily gives the cyclic product:  $o-C_6H_4CHCl_2POCl_2$ , which with alic. opens the ring yielding  $o-C_6H_4(OH)C_6H_4Cl_2$  ( $PCl_3$ OR). The phosphonyl dichlorides readily form the corresponding free acids and esters with  $H_2O$  and alic. Typical procedure: 1 mole aldehyde and 1.5 moles  $PCl_3$  (or 1 mole of any 3-valent P halide) are heated in sealed tube 3-6 hrs. at  $160-200^\circ$  ( $CH_3$  required  $200^\circ$ , some others needed but  $160-200^\circ$ ); on cooling, the viscous liquid was pumped free of  $HCl$  at a water pump, then distilled under a good vacuum. Only  $PCl_3$  gave a poorly distillable product which was not obtained in pure state. The following products were obtained:  $C_6H_5POCl_2$  (40% from  $CH_3$  and  $PCl_3$ ), bp  $77-8^\circ$ ,  $d_4^{20}$  1.0291,  $n_D^{20}$  1.4978 (cf. Yakubovich and Ginsburg, *C.A.* 45, 2867g); free acid,  $m$  80%; di-Me ester, bp  $60-60^\circ$ ,  $d_4^{20}$  1.0281,  $n_D^{20}$  1.4475; di-Et ester, bp  $101^\circ$ ,  $d_4^{20}$  1.092,  $n_D^{20}$  1.4115;  $o-C_6H_4(OH)C_6H_4Cl_2$  (48% from  $CH_3$ ) and  $o-C_6H_4(OH)C_6H_4Cl_2$  (12% from  $CH_3$  and  $PCl_3$ ), bp  $123-120^\circ$ ,  $d_4^{20}$  1.0706,  $n_D^{20}$  1.6100;  $M_2CHClPOCl_2$  (14% from

Summary W-19087, 13 Aug 51

CA

(MeCHO), and PCl<sub>5</sub> or 10% using AcCl as such, b.p. 71  
 2°, d<sub>4</sub><sup>20</sup> 1.5131, n<sub>D</sub><sup>20</sup> 1.4911; free acid, m. 98-9°, d<sub>4</sub><sup>20</sup> 1.3508,  
 PCl<sub>5</sub> (10% from P<sub>2</sub>Cl<sub>4</sub> and PCl<sub>5</sub>), b.p. 107°, d<sub>4</sub><sup>20</sup> 1.3508,  
 n<sub>D</sub><sup>20</sup> 1.4886; free acid, m. 80-7°, PCl<sub>5</sub>/CH<sub>2</sub>POCl<sub>2</sub> (62% from  
 Ball and PCl<sub>5</sub>), m. 60-1°, b.p. 124-0°, d<sub>4</sub><sup>20</sup> 1.4334, n<sub>D</sub><sup>20</sup> 1.4666,  
 free acid, m. 134°, di-Me ester, b.p. 127°, d<sub>4</sub><sup>20</sup> 1.2811, n<sub>D</sub><sup>20</sup>  
 1.5298; di-Et ester, b.p. 128-9°, d<sub>4</sub><sup>20</sup> 1.1920, n<sub>D</sub><sup>20</sup> 1.5125,  
 di-Ph ester (20% from Ball and (PhO)<sub>2</sub>PCl<sub>2</sub>), m. 60-3°, b.p.  
 208-10°, n<sub>D</sub><sup>20</sup> 1.5027 (2); o-phenylene ester (24% from Ball  
 and o-C<sub>6</sub>H<sub>4</sub>(O)PCl<sub>2</sub>), m. about 123°, b.p. 181°, p-MeC<sub>6</sub>H<sub>4</sub>-  
 CH<sub>2</sub>POCl<sub>2</sub> (35% from PCl<sub>5</sub> and p-MeC<sub>6</sub>H<sub>4</sub>CHO), m.  
 52-4°, b.p. 120.5-30.5°; free acid, m. 150-1.5°, p-ClC<sub>6</sub>H<sub>4</sub>-  
 CH<sub>2</sub>POCl<sub>2</sub> (40% from PCl<sub>5</sub> and p-ClC<sub>6</sub>H<sub>4</sub>CHO), m. 58-  
 60.5°, b.p. 144-4.5°; free acid, m. 152-3°, m-O<sub>2</sub>NC<sub>6</sub>H<sub>4</sub>-  
 CH<sub>2</sub>POCl<sub>2</sub> (3.7% from PCl<sub>5</sub> and m-O<sub>2</sub>NC<sub>6</sub>H<sub>4</sub>CHO), m.  
 62.5-4.5°, b.p. 110°; o-C<sub>6</sub>H<sub>4</sub>(CH<sub>2</sub>PO)Cl<sub>2</sub> (10% from  
 PCl<sub>5</sub> and o-HOC<sub>6</sub>H<sub>4</sub>CHO), b.p. 138-40°, d<sub>4</sub><sup>20</sup> 1.3992, n<sub>D</sub><sup>20</sup>  
 1.5700; o-C<sub>6</sub>H<sub>4</sub>(OH)CH<sub>2</sub>POCOH<sub>2</sub>, m. 100-2.5°. While  
 the Fosseck reaction of aldehydes with PCl<sub>5</sub> (Monat., 5,  
 121, 627(1884); 7, 20(1886)) yields poorly crystallizable  
 1-hydroxyphosphonic acids, the present procedure yields  
 readily purifiable Cl analogs. G. M. Kosolapoff

KABACHNIK, M. I.

PA 174T13

USSR/Chemistry - Organophosphorous Compounds Jan/Feb 51

"Brief Communications: Toward the Synthesis of Aminomethylphosphonic Acid," M. I. Kabachnik, T. Ya. Medved', Inst Org Chem, Acad Sci USSR

"Iz Ak Nauk SSSR, Otdel Khim Nauk" No 1, pp 95-97

Describes gen conditions for synthesis of amino-methylphosphonic acid by action of ammonia on ethyl ester of chloro- or iodomethylphosphonic acid, yielding monoethyl ester of aminomethylphosphonic acid, which is saponid to obtain free acid. Details 1st stage (synthesis of monoethyl ester of aminoethylphosphonic acid).

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*Translation W-18444, 19 June 51*

CA

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Organophosphorus compounds. XV. Reaction of formaldehyde with phosphorus trichloride. M. I. Kabachnik and E. S. Shepeleva. *Izv. Akad. Nauk S.S.S.R., Otdel Khim. Nauk* 1951, 185-91; cf. 44, 7257; 45, 6509, 8444. — While  $\text{PCl}_3$  reacts with paraformaldehyde (I) slowly in the cold with formation of a sirup from which no individuals could be isolated, heating such a mixt. in a sealed tube or autoclave, heat to  $230-45^\circ$ , gives  $\text{CICH}_2\text{POCl}_2$  in good yields. Heating 1 mole I with 1.5 mole  $\text{PCl}_3$  10 hrs. to  $238-48^\circ$  yields 0.8 mole  $\text{CICH}_2\text{POCl}_2$ ,  $b_p$   $87-8^\circ$ ,  $b_s$   $84-5^\circ$ ,  $b_m$   $78-9^\circ$ ,  $b_r$   $83-3^\circ$ ,  $n_D^{20}$  1.4978,  $d_4^{20}$  1.6301. The yield is never above 65% however. If an excess of I is used, the yield declines and other products appear; thus 8 g. I and 7.9 g.  $\text{PCl}_3$  after 3 hrs. at  $190-210^\circ$  give 4%  $\text{CICH}_2\text{POCl}_2$  and 0.4 g.  $\text{CICH}_2\text{P(O)(OCH}_2\text{Cl)Cl}$ ,  $b_p$   $84-8^\circ$ ,  $b_s$   $90-101^\circ$ ,  $b_m$   $120^\circ$ ,  $d_4^{20}$  1.5082,  $n_D^{20}$  1.4942. In addn., small amts. of  $\text{CICH}_2\text{P(O)(OCH}_2\text{Cl)}_2$ ,  $b_p$   $120^\circ$ ,  $n_D^{20}$  1.4870, also form, especially when an excess of I is employed. However, such products form in all cases and in addn. all reactions leave behind varying amts. of undistillable residue resulting from internal Arbusov reaction (cf. C.A. 5, 1897) of the probable intermediate  $\text{P(OCH}_2\text{Cl)}$ . The intermediate structure is in accord with previous views on the mechanism of the action of  $\text{PCl}_3$  with carbonyl compds. (see above refs.). The polymeric residue consists of repeating links of the type  $\text{(OCH}_2\text{P(O)(OCH}_2\text{Cl))}_n$ , as heating with  $\text{PCl}_3$  and warming on a steam bath readily gives  $\text{POCl}_3$  and  $\text{CICH}_2\text{POCl}_2$ . The latter treated with MeOH overnight yields  $\text{CICH}_2\text{P(O)(OMe)}_2$ ,  $b_p$   $89-90^\circ$ ,  $n_D^{20}$  1.4425,  $d_4^{20}$  1.3283; EtOH gave the *di-Et* analog,  $b_p$   $101^\circ$ ,  $n_D^{20}$  1.4415,  $d_4^{20}$  1.1992. While  $\text{HPOCl}_2$  hydrolyzes readily in moist air, the free acid is obtained in the pure state only after heating with  $\text{H}_2\text{O}$  on a water bath, evapn., and removal of the  $\text{HCl}$  by evapn. with EtOH; pure  $\text{CICH}_2\text{P(O)(OH)}_2$ ,  $m.$   $86-7.5^\circ$  (from MePh- $\text{H}_2\text{O}$ ). Heated with  $\text{H}_2\text{O}$  3 hrs. to  $250^\circ$ , it yields pure  $\text{HOCH}_2\text{P(O)(OH)}_2$ ,  $m.$   $98-9^\circ$  (from EtOH-EtOAc, followed by thorough drying).  
O. M. Kosolapoff

Summary W-216 25, 6 Nov 52

KABACHNIK, M.I.

RT-778 [Investigation into the field of organophosphorous compounds. Part 15]  
Issledovanie v oblasti fosfororganicheskikh soedinenii. Soobshchenie XV.  
Izvestia Akademii Nauk SSSR. Otdelenie Khimicheskikh Nauk, (1): 485-491, 1951.

KADACHNIK, M. I.

USSR/Chemistry - Organophosphorus Compounds Sep/Oct 51

"Alkylation of Aminomethylphosphonic Acid," T. Ya. Medved', M. I. Kadachnik, Inst of Org Chem, Acad Sci USSR

"Iz Ak Nauk SSSR, Otdel Khim Nauk" No 5, pp 620-624

found that N-alkylation occurs when aminomethylphosphonic acid (I) interacts with alkyl sulfates.  $Mn_2O_3$  in alk soln reacts smoothly with I to form  $\beta$ -analogue of betaine: phosphobetaine (II).  $Et_2SO_4$  reacts with I less smoothly, forming II and products of incomplete ethylation on N atom.

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USSR/Chemistry - Organophosphorus Compounds (Contd) Sep/Oct 51

studied some properties and derive of these compounds. Conditions of formation and properties of betaine and II are very similar, sp differences being caused by divalent nature of  $PO(OEt)_2$  group and difficulty of its alkylation.

195T23

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Chemical Abst.  
Vol. 48 No. 9  
May 10, 1954  
Organic Chemistry

4  
② chem  
/ The reaction of phosphorus trichloride with cyclic un-  
saturated ketones. G. I. Kibachnik and T. Ya. Nledved.  
Dokl. Akad. Nauk S.S.S.R., Div. Chem. Sci. 1952, 817-22  
(Engl. translation).—See C.A. 47, 4848b. H. L. H.

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KABACHNIK, M. I.

Chemical Abst.  
Vol. 48 No. 9  
May 10, 1954  
Organic Chemistry

3

② Chem

Organophosphorus compounds. Reaction of phosphorus  
sulfides with alcohols. M. I. Kabachnik and L. A. Mas-  
lovskaya. *Bull. Acad. Sci. U.S.S.R. Div. Chem. Sci.*  
1952, 601-6 (Engl. translation).—See C.A. 47, 9900a.  
H. L. H.

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KABACHNIK, M.I.

Chem Abstr 148  
1-25-54

Organic Chemistry

~~Amphomethylphosphonic acid~~ M. I. Kabachnik and T. V. Mironov, *Russ. Jour. S.S.S.R., Appl. Org. Chem., Siniyev Org. Soderenii, Sbornik 2, 12-14 (1952); et. C.A. 45, 8444b; 46, 421c; Chavane, C.A. 43, 124b.* Heating 50 g.  $\text{ClCH}_2\text{P}(\text{O})(\text{OEt})_2$  and 240 ml. 25%  $\text{NH}_4\text{OH}$  in sealed tubes 1 hr. at  $130^\circ$  (the tubes are best heated in an autoclave or bomb with suitable counterpressure of about 25-30 atm. to prevent rupture) and evapn. of the contents on a steam bath gave a sirup. This, in small vol. of  $\text{H}_2\text{O}$  was shaken with 35 g. fresh moist  $\text{Ag}_2\text{O}$  and filtered. The filtrate was freed of  $\text{Ag}$  with  $\text{H}_2\text{S}$ , filtered and the filtrate and wash  $\text{H}_2\text{O}$  combined and evapd. to constant vol. The yellowish residue was taken up in small vol. of 95%  $\text{EtOH}$  and treated with  $\text{EtOH}$  soln. of 54 g.  $\text{PhNH}_2$  (3 mols per mole of original ester). After prolonged standing a ppt. of  $(\text{H}_2\text{NCH}_2\text{P}(\text{O})(\text{OEt})\text{OH})_2 \cdot \text{PhNH}_2$  was filtered off and washed with  $\text{EtOH}$ ; yield 26-7 g., m.  $230^\circ$ . The  $\text{PhNH}_2$  is removed either by crystn. from aq.  $\text{EtOH}$  or by heating to  $100^\circ$  at 2-4 mm. for several hrs. to constant wt. If the former procedure is used, the  $\text{PhNH}_2$  salt is treated with 100-120 ml. hot 95%  $\text{EtOH}$  (partial soln.) and the hot soln. is treated dropwise with  $\text{H}_2\text{O}$  until clear; the filtered soln. is cooled and treated with excess abs.  $\text{EtOH}$ , yielding 16-17 g.  $\text{H}_2\text{NCH}_2\text{P}(\text{O})(\text{OEt})\text{OH}$ , m.  $240^\circ$ . This (3 g.) and 50 ml. 1:1  $\text{HCl}$  was heated in sealed tube 3 hrs. at  $120-40^\circ$ , evapd. on a water bath, the residue taken up in little  $\text{H}_2\text{O}$  and pptd.

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7-28-54

Review W-28970, 16 Dec 53

KABACHNIK, P. I.

Chem abs V48

1-28-54

Organic Chemistry

The chloride of 2-chloroethylphosphonic acid. M. I. Kabachnik and L. A. Rosolitskaya. *Izv. Akad. Nauk S.S.S.R., Inst. Org. Khim., Silyesky Org. Soedinenii, Sbornik 2*, 142-3 (1952); cf. *C.A.* 42, 7242c. — Into 137.5 g.  $PCl_5$  was passed ethylene oxide at about  $20^\circ$  until a wt. gain of at least 132 g. was attained. The mixt. was kept overnight and then heated cautiously, with protection from moisture, to  $160^\circ$  (if heating is rapid, the reaction may get out of control) for 5 hrs. The product, containing  $OP(OCH_2CH_2Cl)_2$ , was sepd. into 20 g. portions, each of which was heated with 32 g.  $PCl_5$  in sealed tube 2.5 hrs. at  $150^\circ$ . Distn. yielded 50-2.5%  $C_2H_5CH_2POCl_2$ ,  $b_{2.4}$   $82-4^\circ$ ,  $b_2$   $68^\circ$ ,  $b_{7m}$   $213-17^\circ$  (decompn.),  $d_4^{20}$  1.5443,  $d_{16}$  1.5430,  $n_D^{20}$  1.4977. Hydrolysis yields  $C_2H_5CH_2PO(OH)_2$ , m.  $74^\circ$ . G. M. K.

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1-28-54

KABACHNIK, M. I.

Chem Abs 048

1-25-54

Organic Chemistry

~~Chloromethylphosphonic acid. M. I. Kabachnik and H. S. Sheneleva. *Trud. Akad. Nauk S.S.S.R. (Ser. Khim. i Sintezy Org. Soedinenii, Sbornik 2, 150-1 (1952); cf. C.A. 45, 6589i, 10101b; Prut. et al., C.A. 44, 8800i.*—Heating 200 g. PCl<sub>3</sub> and 30 g. paraformaldehyde in autoclave 10 hrs. at 250° yields 60-65% CICH<sub>2</sub>POCl<sub>2</sub>, b<sub>1</sub> 87-8°, b<sub>2</sub> 52-3°, n<sub>D</sub><sup>20</sup> 1.4978, d<sub>4</sub> 1.8301. This added to 15 parts H<sub>2</sub>O (external cooling may be needed in large run) undergoes hydrolysis; the soln. is evapd. on a steam bath, reevapd. after addn. of H<sub>2</sub>O, and kept in a desiccator with KOH to yield crude CICH<sub>2</sub>PO(OH)<sub>2</sub>, which is purified by soln. in Et<sub>2</sub>O-MePh and slow evapn. of the solvents in a vessel with H<sub>2</sub>SO<sub>4</sub> and paraffin chips. The acid m. 80-7.6°. G. M. K.~~

Chem  
③

MF  
1-28-54

Review W-28931, 14 Dec 53

KABACHNIK, M. I.

USSR/Chemistry - Organo-Phosphorous Compounds May/Jan 52

"Type Reaction of Phosphorous Trichloride With Cyclic Unsaturated Ketones," M.I. Kabachnik, T. Ya Medvedev, Inst of Org Chem, Acad Sci USSR

"Iz Ak Nauk, Otdel Khim Nauk" No 3, pp 540-546

$PCl_3$  adds to cyclic  $\alpha, \beta$ -unsatd ketones. After hydrolysis, cyclic  $\beta$ -ketophosphonic acids are formed. Cyclic  $\beta$ -ketophosphonic acids of identical structure are obtained by addn of diethylphosphite to cyclic  $\alpha, \beta$ -unsatd ketones with subsequent saponification of

220720

the ester which is formed. The fact that  $\beta$ -keto-phosphonic acids are formed from cyclic  $\alpha, \beta$ -unsatd ketones refutes Conant's hypothesis of the mechanism of the addn reaction of  $PCl_3$  to these ketones.

220720

KABACHNIK, M. I.

Card 1 of 2

USER/Chemistry - Organophosphorus Compounds Jul/Aug 52

"Investigation in the Field of Organophosphorus Compounds. The Reaction of Phosphorus Sulfides With Alcohols," M. I. Kabachnik, T. A. Mastryukova, Inst of Org Chem, Acad Sci USSR

"Iz Ak Nauk SSSR, Otdel Khim Nauk" No 4, pp 727-735

Investigated the reactions of  $P_4S_7$ ,  $P_4S_6$  and  $P_4S_5$  with alcs. Found that in the reaction of ethyl, propyl, or butyl alc with  $P_4S_7$ ,  $(RO)_2PSH$ ,  $(RO)_2PSSE$ ,

(1)

219T21

(CA 47.no.19:9909 '53)

Card 2 of 2

and  $(RO)_2(RS)PS$  are formed. The action of  $P_4S_7$  on methyl alc results in the formation of  $(CH_3O)_2PSH$  and  $(CH_3O)(CH_2S)PS$ . The action of  $P_4S_6$  on alcs results in the formation of  $(RO)_2PSH$  and  $(RO)_2(RS)PS$ . With isopropyl alc  $P_4S_6$  reacts differently, forming  $(iso-C_3H_7O)_2PSH$  and  $(iso-C_3H_7O)_2PSSH$ . The reaction of  $P_4S_5$  or of a phosphorus-sulfur melt having the atomic ratio 1:1 with alcs leads to the same products as the reaction with  $P_4S_6$ , but the yields are smaller. Prepd for the 1st time

229T21

dialkylidithiophosphates  $(RO)_2PSSH$  and showed that they are liquids which can be distd in vacuum.

(3)

229T21

KABACHNIK, M. I.

PA22714

USSR/Chemistry - Theory of Tautomerism 21 Mar 52

"The Theory of Prototropic Tautomeric Equilibrium in Solutions," M. I. Kabachnik

"Dok Ak Nauk SSSR" Vol 83, No 3, pp 407 - 410

Ionic tautomeric transformation in solns takes place according to the following scheme:  $KH \rightleftharpoons A^- / H^+ \rightleftharpoons EH$ , where KH - ketone,  $A^-$  - keto-enol anion, and EH - enol. The protophytic solvent expedites the ionization preceding formation of the equil. The relationship between consts for keto-enol tautomeric equilibria in 2 different solvents is described by a straight line with a slope equal to one. Tautomeric keto-enol equil is a type of protolytic acid-base equil. Presented by Acad A. N. Nesmeyanov 30 Jan 52. 21714

KABACHNIK, M. I.

USSR/Chemistry - Organo-Phosphorus  
Compounds

11 Apr 52

"A New Method of Synthesizing alpha-Aminophosphonic  
Acids," M. I. Kabachnik, T. Ya. Medved'

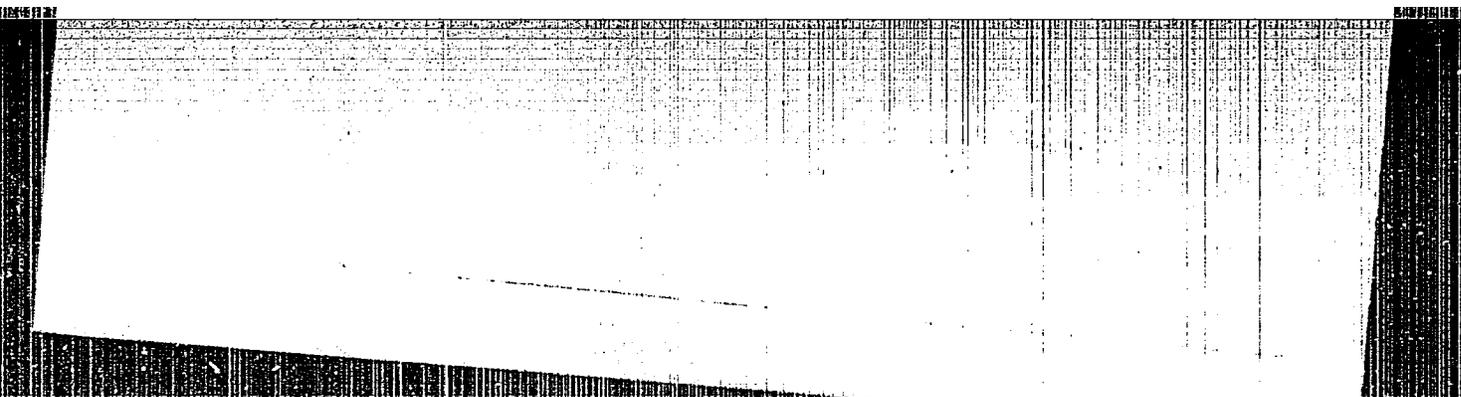
"Dok Ak Nauk SSSR" Vol LXXXIII, No 5, pp 689-692

Dialkyl phosphites in many respects behave like  
malonic or acetoacetic esters. They were found  
to react similarly to malonic ester with ammonia  
and aldehydes, forming alpha-aminophosphonic acids.  
Benzaldehyde and piperonal were used as starting  
materials in the synthesis of alpha-aminophosphonic  
acid esters by this method. Describes the resulting  
esters and acids.

21875

"APPROVED FOR RELEASE: 08/10/2001

CIA-RDP86-00513R000619720012-3



APPROVED FOR RELEASE: 08/10/2001

CIA-RDP86-00513R000619720012-3"

KABACHNIK, M. I.

232T6

USSR/Chemistry - Organophosphorus Compounds 1 Jun 52

"A New Method of Synthesizing Aminophosphonic Acids - Reaction of Ketones With Dialkylphosphites and Ammonia," T. Ya. Medved', M. I. Kabachnik, Inst of Org Chem, Acad Sci USSR

"Dok Ak Nauk SSSR" Vol 84, No 4, pp 717-720

In a previous paper, "Dok Ak Nauk SSSR" Vol 84, no 5, 1952, a new method for prep aminophosphonic acids from aldehydes, ammonia, and dialkylphosphites was described. The same method

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is found to work equally well with ketones. It can be used to prep esters as well as the free acids. The reaction can be used with aliphatic, alicyclic, fatty-aromatic, and aromatic ketones in this order of reactivity. The following were prepared: diethyl-1-hydroxyethylphosphonic acid; ethyl phosphonic acid; ethyl ester pterate; diethyl ester of ethyl phosphonic acid; diethyl ester of alpha-amino-2-propanol; diethyl ester of alpha-amino-2-butanol; diethyl ester of alpha-amino-3-pentanol; diethyl ester of alpha-amino-3-hexanol; diethyl ester of alpha-amino-4-heptanol; diethyl ester of alpha-amino-5-octanol; diethyl ester of alpha-amino-6-nonanol; diethyl ester of alpha-amino-7-decanol; diethyl ester of alpha-amino-8-undecanol; diethyl ester of alpha-amino-9-dodecanol; diethyl ester of alpha-amino-10-tridecanol; diethyl ester of alpha-amino-11-tetradecanol; diethyl ester of alpha-amino-12-pentadecanol; diethyl ester of alpha-amino-13-hexadecanol; diethyl ester of alpha-amino-14-heptadecanol; diethyl ester of alpha-amino-15-octadecanol; diethyl ester of alpha-amino-16-nonadecanol; diethyl ester of alpha-amino-17-eicosanol; diethyl ester of alpha-amino-18-heneicosanol; diethyl ester of alpha-amino-19-docosanol; diethyl ester of alpha-amino-20-tricosanol; diethyl ester of alpha-amino-21-tetracosanol; diethyl ester of alpha-amino-22-pentacosanol; diethyl ester of alpha-amino-23-hexacosanol; diethyl ester of alpha-amino-24-heptacosanol; diethyl ester of alpha-amino-25-octacosanol; diethyl ester of alpha-amino-26-nonacosanol; diethyl ester of alpha-amino-27-triacontanol; diethyl ester of alpha-amino-28-tetracontanol; diethyl ester of alpha-amino-29-pentacontanol; diethyl ester of alpha-amino-30-hexacontanol; diethyl ester of alpha-amino-31-heptacontanol; diethyl ester of alpha-amino-32-octacontanol; diethyl ester of alpha-amino-33-nonacontanol; diethyl ester of alpha-amino-34-decacontanol; diethyl ester of alpha-amino-35-triacontanol; diethyl ester of alpha-amino-36-tetracontanol; diethyl ester of alpha-amino-37-pentacontanol; diethyl ester of alpha-amino-38-hexacontanol; diethyl ester of alpha-amino-39-heptacontanol; diethyl ester of alpha-amino-40-octacontanol; diethyl ester of alpha-amino-41-nonacontanol; diethyl ester of alpha-amino-42-decacontanol; diethyl ester of alpha-amino-43-triacontanol; diethyl ester of alpha-amino-44-tetracontanol; diethyl ester of alpha-amino-45-pentacontanol; diethyl ester of alpha-amino-46-hexacontanol; diethyl ester of alpha-amino-47-heptacontanol; diethyl ester of alpha-amino-48-octacontanol; diethyl ester of alpha-amino-49-nonacontanol; diethyl ester of alpha-amino-50-decacontanol. A.N. Kozmyanov, II, 1952.

232T6

Theory of dimeric equilibrium. III. Pseudomeric  
Structure and properties of diethyl phosphonates  
Kashchuk and T. A. Masryukina. *Bull. Acad. Sci. Div. Chem. Sci.* 1959, 24(1-3) (Engl. translation).  
See C.A. 48, 2342c.  
Ed. 7.

KABACHNIK, M. I.

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 ② Theory of tautomeric equilibrium. III. Pseudomerism. Structure and properties of dialkyl thiophosphites. M. I. Kabachnik and T. A. Maslyukova. *Dokl. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1953, 103-70; cf. C.A. 46, 8409f. — Phototropic tautomeric equil. is a form of protolytic acid-base equil. in which 2 acids with the same anion exist in a solvent or a base which acts as proton exchanger. Attempts were made to examine the possible system  $(RO)_2P(SH) \rightleftharpoons (RO)_2P(SH_2)$  by means of reactions that would involve the latter form (addn. of cuprous halide, B, RX); none of these reactions took place. Only formation of metallic derivs. could be possibly placed in this category; these appear to have the structure  $(RO)_2P(SM)$ , but the Na salts in their action on  $H_2O$  do not act as salts of a strong acid and are instantly hydrolyzed. Hence in the above system the 1st structure is so predominant that the reactions of the 2nd form are not realized; this fact is contrary to the usual concepts of pseudomerism. A theoretical examn. of the kinetics inherent in pseudomerism Ingold and Thorpe, *New Aspects of Tautomerism*, 1928, p. 17 (C.A. 18, 1111f) indicates admission of such reaction rates that are not actually realized. It is believed that reactions of this group proceed by transfer of the reactive center without involvement in tautomeric transformation. [K. at this point repeats his use of the ideas of resonance in a previous publication, (C.A. 42, 4001f).] All properties of dialkyl thiophosphites indicate the structure  $(RO)_2P(SH)$ ; these are sol. in org. solvents and aq. EtOH, but insol. in  $H_2O$ ; their solns. are neutral; they are insol. in aq. alkalis and are hydrolyzed by acids and alkalis, yielding  $H_3PO_3$ ; they are vigorously oxidized by  $HNO_3$ . On treatment with standard aq. a/c. NaOH they slowly consume alkali because of hydrolysis to  $(RO)_2P(S)(ONa)H$ ; after this the alkali consumption becomes so slow that it is possible to accurately titrate these esters to this endpoint. This is similar to the

Chemical Abst.  
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Organic Chemistry

Kabachnik, M. I.

U S S R .

Reaction of aldehydes with chlorophosphines. M. I. Kabachnik and E. S. Shepelava. *Bull. Acad. Sci. Div. Chem. Sci.* 1953, 763-7 (Engl. translation).—*See C.A.* 49, 843f.

H. L. H.

PK 8/24

KABACHNIK, M. I.

USSR.

New method of synthesis of ...  
Acad. Sci. U.S.S.R., Div. Chem. Sci. 1953, 106-107  
(translation).—See C.A. 49, 810.  
H. L. H.

KAROLIN, M. D.

Reaction of aldehydes with chlorophosphines. M. I. Kubashnik and E. S. Shepeleva (Inst. Org. Chem., Acad. Sci. U.S.S.R., Moscow). *Invest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1953, 662-7; *Ch. C.A.* 44, 6594, 7257; 45, 101915. It is suggested that aldehydes react with chlorophosphines as they do with  $PCl_5$ , i.e., by the way of formation of an  $\alpha$ -chlorinated ester of trivalent P, which then undergoes intermolecular Arbuzov reaction.  $Et_3PCl_2$  (18.1 g.) and 3 g. paraformaldehyde were mixed with cooling and were heated in a sealed tube 2.5 hrs. at  $200^\circ$ ; after 4 fractionations *in vacuo* there was obtained 6.8 g.  $CICH_2P(Et)(O)Cl$ ,  $b_p$  83-4°,  $d_4^{20}$  1.3828,  $n_D^{20}$  1.4987, for 30% yield (for calcn. of molecular refractions in phosphinic acid derive, the atomic refraction of P was taken to be 4.85 as a tentative value). This (2.6 g.) added with cooling to 12 ml. abs. EtOH and allowed to stand overnight, gave after distn. 72% (1.6 g.)  $CICH_2P(Et)(O)OEt$ ,  $b_p$  78-3.5°,  $d_4^{20}$  1.1882,  $n_D^{20}$  1.4670;  $PhPCH_2$  (17.9 g.) and 8 g. paraformaldehyde heated 2 hrs. in sealed tube at  $230-40^\circ$  gave 9.8 g. (47%)  $CICH_2P(Ph)(O)Cl$ ,  $b_p$  116-17°, m. 47-0° (sealed capillary); this chloride treated with  $H_2O$  and evapd. gave 60%  $CICH_2P(Ph)(O)OH$ , m. 93-3.5° (from  $C_6H_6$ -petr. ether, then from  $H_2O$ ), sparingly sol. in  $C_6H_6$ ,  $Et_2O$  or  $H_2O$ . Letting the chloride stand overnight in large excess MeOH (mixed with oct. ) gave 47%  $CICH_2P(Ph)(O)OMe$ ,  $b_p$  125-8°,  $d_4^{20}$  1.2634,  $n_D^{20}$  1.5409; similarly EtOH gave 48% Et ester,  $b_p$  132-4°,  $d_4^{20}$  1.2399,  $n_D^{20}$  1.5275.  $Ph_2PCl$  (2.2 g.) and 0.3 g. paraformaldehyde heated in sealed tube 2 hrs. at  $230-40^\circ$  gave after 2 distns. 0.8 g. (40%)  $Ph_2P(O)CH_2Cl$ ,  $b_p$  146-7°, m. 122-4° to a murky liquid which became clear at  $135-7^\circ$ .  
G. M. Kosolapoff

KABACHNIK, M.I.

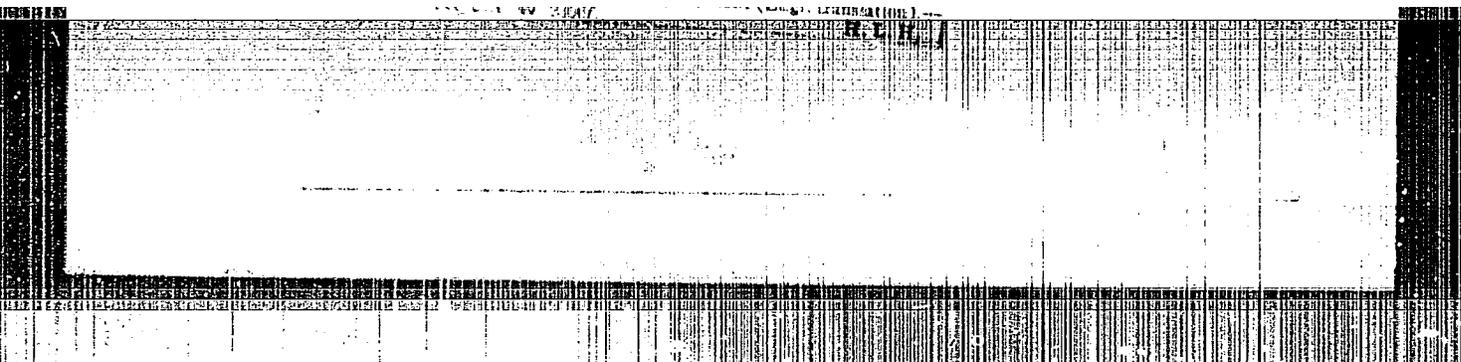
New method of synthesis of  $\alpha$ -aminoalkylphosphonic acids. L. M. I. Kabachnik and T. Ya. Medved (Inst. Chem. Acad. Sci. U.S.S.R., Moscow). *Izv. Akad. Nauk S.S.S.R. Khim. Nauk* 1953, 808, 78. The reaction of aldehydes with dialkyl phosphites in alc. NH<sub>3</sub> medium has been extended to several new amino-phosphonic acids. It is suggested that the reaction proceeds through the formation of an intermediate alkyl phosphite. The reaction of benzaldehyde with diethyl phosphite in alc. NH<sub>3</sub> medium has been extended to several new amino-phosphonic acids. It is suggested that the reaction proceeds through the formation of an intermediate alkyl phosphite. The reaction of benzaldehyde with diethyl phosphite in alc. NH<sub>3</sub> medium has been extended to several new amino-phosphonic acids. It is suggested that the reaction proceeds through the formation of an intermediate alkyl phosphite.

tolluolaldehyde, 6.5 g. (0.045 mole) in 10 ml. EtOH, 10 ml. Et<sub>2</sub>O, 148° (from EtOH) [lit. 148° (from EtOH)]. Yield 4.8 g. (80%). m.p. 100° (decolorized tube 7 hrs. at 100°). *IR* (KBr) 1710 cm<sup>-1</sup> (C=O), 3300 cm<sup>-1</sup> (NH<sub>2</sub>). *ANAL.* Calcd. for C<sub>10</sub>H<sub>15</sub>N<sub>2</sub>O<sub>4</sub>: C, 56.7%; H, 7.0%; N, 36.3%. Found: C, 56.5%; H, 7.2%; N, 36.1%. *lit.* (from EtOH) C, 56.5%; H, 7.0%; N, 36.3%. *lit.* (from EtOH) m.p. 100°. *lit.* (from EtOH) *IR* (KBr) 1710 cm<sup>-1</sup> (C=O), 3300 cm<sup>-1</sup> (NH<sub>2</sub>). *lit.* (from EtOH) *ANAL.* Calcd. for C<sub>10</sub>H<sub>15</sub>N<sub>2</sub>O<sub>4</sub>: C, 56.7%; H, 7.0%; N, 36.3%. Found: C, 56.5%; H, 7.2%; N, 36.1%.

073-022 (from file) RYON... 1953-1954

USSR:

Some derivatives of (antipyrine) benzoic acid.  
Kahachnik and T. V. Medved. *Bull. Acad. Sci. USSR Div. Chem. Sci.* 1953, 6: 1001-1004.



KABACHNIK, M. I.

"Research in the Field of Organophosphorous Compounds. Concerning Dialkyl-dithiophosphates," By M. I. Kabachnik and T. A. Mastryukova, Inst. of Organic Chemistry, Acad. Sci USSR, Iz Ak Nauk SSSR, O Kh. N, No 1, pp 121-125, Jan/Feb 53.

For the first time, dialkyldithiophosphates were obtained in a pure form, as liquids distilled under vacuum. Some of their properties were investigated. It was demonstrated that the dialkyldithiophosphates formed in the reaction of alcohols with the phosphorous sulfides,  $P_4S_7$  and  $P_4S_{10}$ , are identical. It was further shown that, during oxidation with iodine, aliphatic dialkyldithiophosphates from the corresponding disulfides.

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*KABACHNIK, M. I.*

USSR/Chemistry

Card 1/1 : Pub. 40 - 13/22

Authors : Kabachnik, M. I., and Shepeleva, E. S.

Title : About the reaction of aldehydes with chlorophosphines.

Periodical : Izv. AN SSSR. Otd. khim. nauk 5, 862-867, Sep-Oct 1953

Abstract : The reaction of para-formaldehyde with the most accessible dichlorophosphines - ethyldichlorophosphine and phosphenyl chloride, was investigated. Results indicate that para-formaldehyde reacts with alkyl- and aryl dichlorophosphines resulting in the formation of secondary alkyl (or aryl)-chloromethylphosphinic chlorides. The derivation of free acids and their esters is described. The products obtained from the reaction of diphenylchlorophosphine with para-formaldehyde, are listed. Eight references: 5-USSR and 3-German (1876-1951). Table.

Institution : Academy of Sciences, USSR, Institute of Organic Chemistry

Submitted : December 31, 1952

**KABACHNIK, M. I.****USSR/** Chemistry - Synthesis methods**Card** 1/1 : Pub. 40 - 14/22**Authors** : Kabachnik, M. I., and Medved', T. Ya.**Title** : ~~Method of synthesizing alpha-aminoalkylphosphinic acids.~~ New method of synthesizing alpha-aminoalkylphosphinic acids. Part 1.-**Periodical** : Izv. AN SSSR. Otd. khim. nauk 5, 868-878, Sep-Oct 1953**Abstract** : The reaction of aromatic aldehydes, with ammonia and dialkylphosphites, was investigated. It was established that during heating this reaction leads to the formation of alpha-aminoalkylphosphinic acids the saponification of which yields free acids. The synthesis of alpha-aminophosphinic acids from benzaldehyde, p-toluene aldehyde, cumin aldehyde, anisaldehyde, piperonal and vanillin, is described. It was found that benzaldehyde reacts with dialkylphosphites, when exposed to cold air, resulting in the formation of alpha-oxybenzylphosphinic acid ester which, when heated with ammonia, converts into alpha-amino-phosphinic acid ester. Fifteen references: 8-USSR; 5-USA; 1-French and 1-German (1881-1952). Tables.**Institution** : Academy of Sciences USSR, Institute of Organic Chemistry**Submitted** : December 23, 1952

KABACHNIK, M. I.

USSR/Chemistry - Phosphorus Organic Compounds Nov/Dec 53

"Some Derivatives of Aminomethylphosphonic Acid,"  
M.I. Kabachnik, T.Ya. Medved', Inst Org Chem, Acad  
Sci USSR

Iz Ak Nauk SSSR, OZhN, No 6, pp 1126-1128

Aminomethylphosphonic acid (I) acetylates with  
greater difficulty than glycine. N-acetylami-  
no-methylphosphonic acid, N-thloracetylaminophosphonic  
acid, and N-phthalimidomethylphosphonic acid have  
been prepared. Methylation of I with MeI in MeOH  
resulted in phosphobetaine iodide. MeOH

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participates in the methylation, because the re-  
action proceeds to completion with a quantity  
of MeI much smaller than the theoretical.

KADACHNIK, M. I.

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General and Physical Chemistry

(3)

Theory of tautomeric equilibrium. Effect of solvent on the acidity of the tautomeric forms and position of keto-enol equilibrium. M. I. Kadachnik and B. T. Ioffe (Inst. Org. Chem. Acad. Sci. USSR, Moscow). Doklady Akad. Nauk S.S.S.R. 91, 813-3 (1953). -- It was previously shown (C.A. 46, 8499f) that the const. of tautomeric equil.  $K_{TS}$  can be expressed as  $K_{TS} = K_{KS}/K_{ES}$ , where  $K_{KS}$  is the const. of acidic ionization of ketonic forms in a given solvent, and  $K_{ES}$  is the const. of ionization of the enolic forms. By the use of the Brønsted concept of protolytic equilibria and soln. of the 2 simultaneous equations:  $pK_{KS} = pK_{KS_1} + \text{const.}$  and  $pK_{ES} = pK_{ES_1} + \text{const.}$  gives  $pK_{TS} = pK_{TS_1} + \text{const.}$  for enol-keto systems in 2 solvents  $S_1$  and  $S_2$ . Exptl. detn. of ionization consts. of tautomeric compds., however, yields only some summary const. of the equil. mixt. (*ibid.* 83, 859(1953)). However, exptl. detn. of the ionization const. of the equil. system  $K_{KS}$  and detn. of the const. of tautomeric equil.  $K_{TS}$  permits the calcn. of the individual ionization consts. from:  $K_{KS} = K_{KS_1}(K_{TS} + 1)$  and  $K_{ES} = K_{ES_1}(K_{TS} + 1)/K_{TS}$ . The consts.  $K_{KS}$  were detd. by measurement of pH of partially neutralized solns. by means of a glass electrode. Calcns. of  $K_{ES}$  were made by the formula:  $K_{ES} = \frac{([Na^+] + [H^+] - (K_w/[H^+]))([H^+]/M - ([Na^+] + [H^+] - (K_w/[H^+])))}{[H^+]}$ . Plots of  $pK_{TS}$  and  $pK_{TS_1}$  gave linear curves, justifying the above formulation and permitting the calcns. of the individual consts. in solvent pairs of H<sub>2</sub>O and 70% aq. dioxane. The following values are found for the enol content in water and aq. dioxane: acetylacetone 10% and 83%; Et acetoacetate 0.5 and 3%; benzoylacetone 49% and 81%; formylcyclopentanone 40% and 70%; 2-methylindane-1-one 1% and 0%; Et benzoylacetate 1% and 0%. The calcd. values of  $K_{TS}$ ,  $K_{KS}$ ,  $K_{ES}$ , and  $K_{TS_1}$  are tabulated.

G. M. Kuroshidoff

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*K. K. Kozlov, M.I.*

**Synthesis of esters of  $\alpha$ -aminoalkylthiophosphonic acids.**  
 M. I. Kabachnik, T. Ya. Medvedev, and T. A. Mastyukova  
 (Inst. Org. Chem., Acad. Sci. U.S.S.R., Moscow). *Doklady Akad. Nauk S.S.S.R.* 92, 959-62 (1953); cf. *C.A.* 47, 3226c, 9909g; 48, 3243z; following abstr.—In  $(RO)_2PSH$ , the tautomeric shift from  $(RO)_2P(S)H$  to  $(RO)_2P(S)H$  is relatively small, but in presence of RONA these esters form salts which are based on trivalent P:  $(RO)_2P(S)Na^+$ , which on alkylation yield  $R'P(S)OR$ . The thio esters react with carbonyl compounds in the presence of  $NH_3$ , yielding esters of aminothiophosphonic acids, the reaction being more smooth than with the corresponding  $(RO)_2POH$ . The thiophosphites were heated with equiv. amts. of aldehydes or ketones in the presence of 50% excess 10%  $NH_3$  in abs. EtOH in a sealed tube 3 hrs. at 100°. The products were then distd. *in vacuo*. With  $H_2H$  and AcPh the reaction required 6 hrs. and the products were isolated as picrates. The following esters were obtained: 53%  $Me_2C(NH_2)PS(OEt)_2$ , b<sub>p</sub> 83-4°, d<sub>4</sub> 1.0543, n<sub>D</sub> 1.4700; 80% *di-iso-Pr ester*, b<sub>p</sub> 87-8°, d<sub>4</sub> 1.0103, n<sub>D</sub> 1.4053; 34% *di-Et ester*, b<sub>p</sub> 120-2°, d<sub>4</sub> 1.0019, n<sub>D</sub> 1.4722; 38%  $Me_2C(NH_2)PS(OEt)_2$ , b<sub>p</sub> 95-6°, d<sub>4</sub> 1.0492, n<sub>D</sub> 1.4808; 56% *di-iso-Pr ester*, b<sub>p</sub> 101-3°

d<sub>4</sub> 1.0204, n<sub>D</sub> 1.4740; 26%  $Me_2C(NH_2)PS(OEt)_2$ , b<sub>p</sub> 93-101°, d<sub>4</sub> 1.0255, n<sub>D</sub> 1.4708; 45% *di-iso-Pr ester*, b<sub>p</sub> 107-8°, d<sub>4</sub> 0.9931, n<sub>D</sub> 1.4745; 41%  $PhCMe_2(NH_2)PS(OEt)_2$ , b<sub>p</sub> 2,4,6- $PS(OEt)_2$ , m. 175-8°; 33% *di-iso-Pr ester* analog, m. 174°;  $PhCMe_2(NH_2)PS(OEt)_2$ , m. 161-6°;  $PhCMe_2(NH_2)PS(OEt)_2$ , m. 169-71°; 31% *di-iso-Pr ester* analog, m. 170°. Hydrolysis of  $Me_2C(NH_2)PS(OEt)_2$  with 10%  $HCl$  and at 120° at 120° gave  $Me_2C(NH_2)P(O)(OH)_2$ , identical with that reported earlier (cf. *C.A.* 47, 3226c). The reaction is believed to proceed by the way of original formulation of a  $(RO)_2P(S)NH_2$ , based on trivalent P, which then reacts with the carbonyl compds. with transfer of the thioester yielding  $(RO)_2P(S)C(O)NH_2^+$ , which then exchanges  $H^+$  yielding  $NH_3$  and  $(RO)_2P(S)C(O)NH_2$ ; the latter reaction; the HO deriv. reacts with  $NH_3$  yielding the  $(RO)_2P(S)C(O)NH_2NH_3^+$  which equilibrates with the final product and  $H_2O$ . The existence of the ammonium salt shown in the reaction scheme is proved by the fact that it reacts with the soln.  $(EtOH-NH_3)$  on heating to 100° and yields  $(RO)_2P(S)NH_2$ ; the *di-Et ester* salt was characterized, m. 162-3°. The same salt is obtained from pure  $(EtO)_2P(S)H$  and  $NH_3$ .  
 G. M. Kozlov

*KABACHNIK M.I.*

TERBIN, A.N., akademik; KONDRAT'YEV, V.N., akademik; KNUNYANTS, I.L.,  
akademik; KABACHNIK, M.I.; SOKOLOV, H.D., doktor fiz.-mat. nauk;  
REUTOV, O.A., doktor khimicheskikh nauk; MOSKVICHEVA, H.I.,  
tekhnicheskiiy redaktor

[Status of the theory of chemical structure in organic chemistry]  
Sostoianie teorii khimicheskogo stroeniia v organicheskoi khimii.  
Moskva, Izd-vo Akademii nauk SSSR, 1954. 122 p. [Microfilm]

(MLRA 7:10)

1. Chlen-korrespondent AN SSSR (for Kabachnik) 2. Akademiya nauk  
SSSR. Otdeleniye khimicheskikh nauk  
(Chemical structure) (Chemistry, Organic)

KABACHNIK, M.I.

USSR

New method of synthesis of aminophosphonic acids. II.  
Reaction of ketones with diethyl phosphites and ureas.  
T. Ya. Medved and M. I. Kabachnik, *Dokl. Akad. Sci. U.S.S.R. Div. Chem.* 1981, 253-III (Engl. transl.).  
See C.A.B. 48, 10611b.

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KITENCHNIK, M.I.

JSSR A

Atomic refraction of phosphorus and sulfur in dithiophosphates. M. I. Kitenchnik and L. A. Shchegoleva. *Zh. Fiz. Khim.* 1954, 28, 1111; *Bull. Acad. Sci. U.S.S.R., Div. Chem. Sci.* 1954, 28, 1111; *Bull. Acad. Sci. U.S.S.R., Div. Chem. Sci.* 1954, 28, 1111 (Engl. translation). On the basis of the existing data on the constants of ester groups P and S, the value for the group refraction of 2 S atoms in  $(RO)_2PSH$  is deduced to be 18.92, while in  $(RO)_2PSR$  it is 18.72. In the S-acyl esters  $(RO)_2PSCOR$  it is 19.77. The former values show excellent agreement with the value for 2 S atoms in xanthates, indicating that the refraction of S is not altered significantly in passing from C linkage to P linkage. The atomic refraction of S in  $(MeO)_2PS$  is 9.08, which is very close to 9.70, the value for thioester S atom. If this value is true for the dithiophosphates, the atomic refraction of S in this linkage SH is 9.12, that in PSR linkage 9.02, and that in PSC(O) link is 10.07. The authors employed the usual Eisenlohr values for at. refractions, with the O of PO group having the value 2.211 (cf. C.I. 42, 573g). Prepn. of some new esters follows. To 11.5 g.  $(EtO)_2PSH$  was added 7.8 g.  $AcCl$ ; after 2 hrs. at  $65-80^\circ$ , the cooled mixt. was obtained and distd. yielding

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*M. I. KONOLAPOFF*

7.8 g. (85%)  $(EtO)_2P_2S_4Ac$ , b.  $95^\circ$ ,  $n_D^{20}$  1.5151,  $d_4^{20}$  1.1629; the same product formed in 80% yield from  $AcCl$  and  $(EtO)_2P_2S_4K$ ; the product b.  $108-9^\circ$ ,  $n_D^{20}$  1.5123,  $d_4^{20}$  1.1891.  $(iso-PrO)_2P_2S_4Pb$  and  $AcCl$  gave 07%  $(iso-PrO)_2P_2S_4Et$ , b.  $100-1^\circ$ ,  $n_D^{20}$  1.4879,  $d_4^{20}$  1.1177. Similarly was prepd. 70%  $(iso-BuO)_2P_2S_4Ac$ , b.  $125-0^\circ$ ,  $n_D^{20}$  1.4120,  $d_4^{20}$  1.0791. No reaction occurred at room temp. between 8.3 g.  $(iso-PrO)_2P_2S_4Pb$  and 4.2 g.  $EtCl$ ; heating to  $70-80^\circ$  until the resulting liquid began to show a yellow color, followed by cooling and extr. with  $Et_2O$  gave on evapn. of the ext. 80%  $(iso-PrO)_2P_2S_4Br$ , m.  $51-3^\circ$  (from  $EtOH$ ).  $(EtO)_2P_2S_4K$  (11.2 g.) and 9.4 g.  $MeO_2CCl$  (spontaneous reaction) similarly gave 82%  $(EtO)_2P_2S_4CO_2Me$ , b.  $105-3^\circ$ ,  $n_D^{20}$  1.5063,  $d_4^{20}$  1.2171; with  $Et_2O_2CCl$  there formed 91%  $(EtO)_2P_2S_4CO_2Et$ , b.  $115^\circ$ ,  $n_D^{20}$  1.5001,  $d_4^{20}$  1.1891. Similarly were prepd.: 91%  $(EtO)_2P_2S_4CO_2Pr$ , b.  $125^\circ$ ,  $n_D^{20}$  1.4981,  $d_4^{20}$  1.1620; 84%  $(EtO)_2P_2S_4CO_2CH_2CH_3$ , b.  $162-3^\circ$ ,  $n_D^{20}$  1.4889,  $d_4^{20}$  1.1281; 84%  $(EtO)_2P_2S_4CO_2CH_2CH_2CH_3$ , b.  $137-8^\circ$ ,  $n_D^{20}$  1.4925,  $d_4^{20}$  1.1179;  $(iso-PrO)_2P_2S_4CO_2Et$ , 90%, b.  $109-9.5^\circ$ ,  $n_D^{20}$  1.4884,  $d_4^{20}$  1.1801; 90%  $(iso-PrO)_2P_2S_4CO_2CH_2CH_2CH_2CH_3$ , b.  $137-8^\circ$ ,  $n_D^{20}$  1.4841,  $d_4^{20}$  1.0773. It is pointed out that the previous paper (cf. C.A. 48, 5078e) erroneously gives the atomic refraction of thiol S as 9.34, instead of 9.06. C. M. Konolapoff

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2/2

KABACHNIK, M. I.

Atomic refraction of phosphorus and sulfur in phosphorus and organophosphorus compounds. M. I. Kabachnik and M. B. Zhuravskaya, *Acad. Sci. U.S.S.R. Div. Chem. Sci.* 1956, 673-41 (English translation); cf. *C.A.* 49, 9530b. It has been shown previously that  $A_{R_0}$  of P is 3.70 in phosphites, 7.64 in phosphites, and 4.27 in phosphates (aliphatic). However, constancy of P value is obtained only if the calcn. takes into account the nature of the links of the other elements with P. Thus for Cl one should use 0.338, characteristic of hexahalides; the O value is 2.211 (as in ketones or esters); Jones, *et al.* (*C.A.* 27, 6220), found  $A_{R_0}$  0.83 for S in thiophosphates and it was shown earlier (*C.A.* 49, 9246d) that 9.70 is satisfactory for (RO)<sub>2</sub>PSH, as it is for thioketones (Boullet and Rambaut, *C.A.* 43, 13a). Refraction of the 2 S atoms in (RO)<sub>2</sub>(RS)PS is 18.72, i.e., identical with that of xanthates; the same is true of (RO)<sub>2</sub>P(S)SCOR, where the refraction of 2 S atoms is 19.77, i.e., equiv. to that found in EtOC(S)SCOR. To (RO)<sub>2</sub>PS<sub>2</sub>Na (or K) in CCl<sub>4</sub> was added at 5-10° the equiv. amt. of S<sub>2</sub>SCl<sub>2</sub>; the reaction took place rapidly and after 2 hrs. at 40-50° the filtered soln. was distilled, yielding the desired products listed below: 61% (EtO)<sub>2</sub>P(S)SSMe,  $b_p$  100.5-1.5°,  $n_D^{20}$  1.4500,  $d_4^{20}$  1.2146, 66% (iso-PrO)<sub>2</sub>P(S)SSMe,  $b_p$  90-100°,  $n_D^{20}$  1.4267, 1.1471; 39% (EtO)<sub>2</sub>P(S)SSEt,  $b_p$  106-7°,  $n_D^{20}$  1.4431, 1.1810; 48% (iso-PrO)<sub>2</sub>P(S)SSEt,  $b_p$  117-13°,  $n_D^{20}$  1.5240,  $d_4^{20}$  1.1189; 30% (EtO)<sub>2</sub>P(S)SSBu,  $b_p$  139.5-40°,  $n_D^{20}$  1.4806,  $d_4^{20}$  1.1246; 22% (iso-BuO)<sub>2</sub>P(S)SSEt,  $b_p$  129-30°,  $n_D^{20}$  1.5183,  $d_4^{20}$  1.0866. All were yellowish liquids sol. in org. solvents but not in H<sub>2</sub>O. The av. value of refraction of 2 S atoms in these esters was 27.70 (4.013), which closely agrees with the value derived from Me<sub>2</sub>(S)SSMe. C. M. Kowalski

(2)

KAD

*PhP(O)(H)ONH<sub>2</sub>* (III), m. 175° (from EtOH-Et<sub>2</sub>O). If 4 g. Me<sub>2</sub>CO, 13.3 g. *PhP(O)(H)OBu* (b. 120-1°, n<sub>D</sub><sup>20</sup> 1.5077), and 15 ml. 10% NH<sub>3</sub> in EtOH are heated 3 hrs. at 100° as above, there is also obtained I in the same yield as above. Me<sub>2</sub>CO (4.8 g.), 11.5 g. I, and 20 ml. 10% NH<sub>3</sub> in abs. EtOH after 12 hrs. at 100° gave 0.2 g. ppt. on cooling, which was identified as III. Distn. of the filtrate to remove the unreacted ester left behind a residue which taken up in hot EtOH and cooled gave 17% *PhP(O)(CMe<sub>2</sub>EtNH<sub>2</sub>)OH* (IV), decomp. 197-8°, which was very hygroscopic and neutral to

*(O)(Cl)PhNH<sub>2</sub>OH.H<sub>2</sub>O*, m. 218° (from 50% EtOH). Cyclohexanone (6.5 g.), 11.5 g. I, and 17 ml. 10% NH<sub>3</sub> in EtOH heated 12 hrs. at 100° as above, and deacid. gave on addn. of Et<sub>2</sub>O 1.2 g. III; the filtrate with dry Et<sub>2</sub>O gave 31% *PhP(O)(R)OEt.HCl* (R = 1-aminocyclohexyl), which had 2 m.ps. 149° and 193° (from EtOH-Et<sub>2</sub>O); this (5 g.) in 10 ml. H<sub>2</sub>O was treated with satd. Na<sub>2</sub>CO<sub>3</sub> aq. soln. with Et<sub>2</sub>O, yielding on evapn. of the ext. the oily free ester, which with picric acid gave the corresponding monopyrrol. m. 168° (from EtOH); hydrolysis of the ester HCl salt with HCl 3 hrs. at 115-25° followed by evapn. gave 75% *PhP(O)-*

M. I. KARACHIN

(R)OH, m. 212° (from H<sub>2</sub>O), obtained as the monohydrate, which was neutral in aq. soln. Heating 0.9 g. II and 8 g. Ac<sub>2</sub>O 1.5 hrs. at reflux gave on evap.: 78% N-Ac deriv., m. 197-8° (from EtOH). To 17 g. I and 5.8 g. Me<sub>2</sub>CO was added dropwise 0.4 ml. EtONa-EtOH, resulting in exothermic reaction; after 0.5 hr. on a steam bath the cooled mixture gave 23% PkP(O)(CMe<sub>2</sub>OH)OEt, m. 94-0° (from abs. EtOH). I (3 g.) in 25 ml. H<sub>2</sub>O was treated with ice cooling with N oxides 2 hrs., then heated 15 min. to 40° and evapd. in vacuo gave 40% PkP(O)(CMe<sub>2</sub>OH)OH, m. 163° (from CHCl<sub>3</sub>-petr. ether); the same acid is formed on hydrolysis of its Et ester by 1:1 HCl 3 hrs. at 120-3° followed by evapn. The mechanism of formation of the amino-phosphite is discussed. G. M. Koslovoff

KABACHNIK, M.I.

MEDVED', T.Ya.; KABACHNIK, M.I.

New synthesis of aminophosphinic acids. Report no.2. Reaction of ketones with dialkylphosphites and ammonia. Izv.AN SSSR. Otd.khim.nauk no.2:314-322 Mr-Ap '54. (MIRA 7:6)

1. Institut organicheskoy khimii im. N.D.Zelinskogo Akademii nauk SSSR.

(Ketones) (Phosphites) (Ammonia) (Phosphinic acid)

*KABACHNIK, M. I.*

USSR/Chemistry      Physical Chemistry

**Card** : 1/1

**Authors** : Kabachnik, M. I., and Mastryukova, T. A.

**Title** : About the atomic refraction of phosphorus and sulfur in dithiophosphates

**Periodical** : Izv. AN SSSR, Otd. Khim. Nauk., 3, 436 - 441, May - June 1954

**Abstract** : Experiments were conducted to determine whether the magnitudes of atomic refraction of phosphorus-bound sulfur are homologous to the atomic refractions of carbon bound sulfur. The constitutional effects affecting atomic refraction of phosphorus in organic substances and its dependence upon the valent state of the element and nature of formed bonds, are explained. Values were established for a group refraction of two sulfur atoms in esters and mixed anhydrides of dithiophosphoric acid. Twelve references: 6 USSR since 1897, 4 USA, 1 German, 1 Italian. Table.

**Institution** : Acad. of Sc. USSR, The M. D. Zelinskiy Institute of Organ. Chem.

**Submitted** : June 5, 1953

KABACHNIK, M. I.

USSR/ Chemistry      Physical chemistry

Card            : 1/1      Pub. 40 - 25/27

Authors        : Kabachnik, M. I., Mastryukova, T. A., and Golyna, E. I.

Title          : About atomic refraction of P and S in polythio-organic phosphorus compounds

Periodical     : Izv. AN SSSR, Otd. khim. nauk 4, 743 - 745, July - August 1954

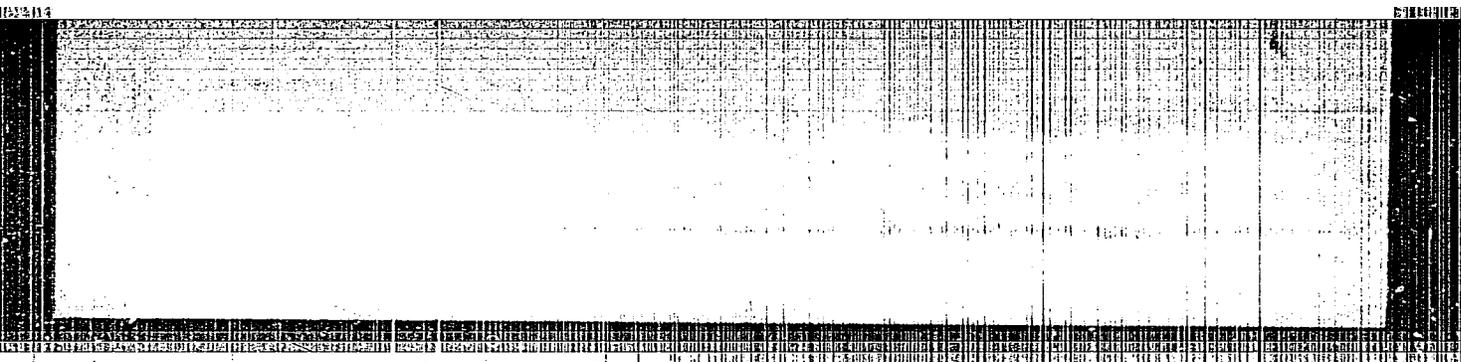
Abstract       : Experiments showed that the molecular refractions of polythio-organic phosphorus compounds can be quite accurately computed provided the value of the atomic refraction of the S-atom 9.70 is taken into consideration. Data on the constancy of atomic refraction of P, in identical organo-phosphorus compounds, are included. Ten references: 3 USSR; 1 German; 2 French and 4 USA (1905 - 1954). Table.

Institution    : Acad. of Sc. USSR, The N. D. Zelinskiy Institute of Organic Chemistry

Submitted      : March 13, 1954

"APPROVED FOR RELEASE: 08/10/2001

CIA-RDP86-00513R000619720012-3



APPROVED FOR RELEASE: 08/10/2001

CIA-RDP86-00513R000619720012-3"

KABACHNIK, . . .

## USSR/Chemistry

**Card** : 1/1

**Authors** : Kabachnik, M. I., Memb. Corres. of Acad. of Sc. USSR., Yakushkina, S. E. and Kislyakova, N. V.

**Title** : Theory of tautomeric equilibrium. Effect of pressure on tautomeric equilibrium of acetoacetic ester

**Periodical** : Dokl. AN SSSR, 96, Ed. 6, 1169 - 1172, June 1954

**Abstract** : Experiments show that the trans-enol form is the strongest acid of the known three forms of acetoacetic ester. This acid possesses the highest value of the thermodynamic acidity constant  $K_a$ . Its equilibrium content in any given solvent is low. Its content is much higher in leveling solvents (water methyl alcohol) and lower in differentiating solvents (acetone, chloroform, ethyl alcohol, etc.) It responds to solvation with hydroxyl containing solvents much better than any other form. A pressure increase displaces the equilibrium in these solvents toward the trans-enol form which is well noticeable in leveling solvents (water,  $\text{CH}_3\text{OH}$ ). Ten references. Table, graph.

**Institution** : Acad. of Sc. USSR, Institute of Element. Organic Compounds

**Submitted** : March 17, 1954

*KABACHNIK, M. I.*

USSR/Biology - Plant pathology

Card 1/1 Pub. 22 - 40/47

Authors : Ryzhkov, V. L.; Kabachnik, M. I., Memb. Corresp. of Acad. of Sc. USSR;  
Tarasevich, L. M.; Medved, I. Ya.; Zeytlenok, I. A.; Marchenko, N. N.;  
Vagzhanova, V. A.; Ulanova, E. F.; and Cheburkina, N. V.

Title : Biological activity of alpha-aminophosphinic acids

Periodical : Dok. AN SSSR 98/5, 849-852, Oct 11, 1954

Abstract : The biological activity of alpha-aminophosphinic acids (toxic when in large concentrations), is discussed. The biological activity of these acids is best expressed in the inhibition of virus multiplication in the mosaic disease of tobacco. The effect of these acids and glycol on the titer of influenza virus in growing chicken embryos was investigated and the results are described. Eleven references: 7-USSR; 2-USA; 1-French and 1-German (1930-1953). Tables.

Institution : Acad. of Sc. USSR, Institute of Elementary-Organic Compounds and the Academy of Medical Sciences USSR, The D. I. Ivanov Institute of Virusology

Submitted : July 7, 1954

USSR/ Chemistry - Synthesis

Card 1/1 Pub. 22 - 26/56

Authors : Kabachnik, M. I., Memb. Corresp. of Acad. of Sc. USSR.; and Medved', T. Ya.

Title : Derivatives of amino alkyl phosphinic acids. Reaction of amino alkyl phosphinic acid and thiophosphinic acid esters with arylisocyanates

Periodical : Dok. AN SSSR 99/5, 765-767, Dec 11, 1954

Abstract : The synthesis of amino alkyl phosphinic acid ester and arylisocyanate derivatives, which are being formed in accordance with a generally known reaction, is described. Phenylisocyanate and alpha-naphthylisocyanate were used in the role of the arylisocyanates. The reactivity of these esters, when submitted to reaction with arylisocyanates, was found to be very high. The physical properties of these derivatives, which are usually utilized for purposes of identification and analysis, are listed. Three USSR references (1952-1954). Tables.

Institution : Academy of Sciences USSR, Institute of Elementary Organic Compounds

Submitted : July 15, 1954

**Kabachnik, M. I.**

USSR/Chemistry - Tautomeric equilibrium

Card 1/2 Pub. 40 - 13/27

Authors : Kabachnik, M. I.

Title : On the theory of tautomeric equilibrium in solutions

Periodical : Izv. AN SSSR. Otd. khim. nauk 1, 98-108, Jan-Feb 1955

Abstract : Theoretical data are presented regarding the effect of solvation on the equilibrium of ketone and isomeric cis-, trans-enol forms. The tautomeric keto-enol equilibrium in solutions was investigated from the viewpoint of the theory of protolytic acid-base equilibrium.

Institution : Acad. of Sc., USSR, Inst. of Elementary Org. Comp. and the N. D. Zelinskiy Inst. of Org. Chem.

Submitted : March 13, 1954

Card 2/2 Pub. 40 - 13/27

Periodical : Izv. All SSSR. Otd. khim. nauk 1, 98-108, Jan-Feb 1955

Abstract : The three acids participating in the equilibrium of keto-enol solutions with an open chain are listed. The characteristics of these solutions are described with respect to the acid-base equilibrium. The effect of pressure increase on equilibrium displacement is explained. Twenty-two references: 6 USSR, 2 USA, 1 Swiss, 12 German and 1 Turkish (1911--1954). Table.

NESMEYANOV, A. N.; KABACHNIK, M. I.

"Dual Reactivity and Tautomerism"; Zhur Obsheei Khim 25, 41-87 (1955).

N. D. Zelinskii Institute of Organic Chemistry of the Academy of Sciences in Moscow.

B85958, 15 Jun 55

KABACHNIK, M.I.; IOFFE, S.T.; MASTRYUKOVA, T.A.

Theory of tautomeric equilibrium in solutions. Tautomerism of di-alkylthiophosphates. Zhur.ob.khim. 25 no.4:684-693 Ap'55.  
(MIRA 8:7)

1. Institut elementoorganicheskikh soyedineniy Akademii nauk SSSR.  
(Thiophosphates) (Tautomerism)

Капачник, М. Л.

*chem* Reactivity of alkali salts of dialkyl thiophosphoric anion.  
1. Reactions of alkylation. M. I. Kabachnik and T. V. Mistryukova. *J. Gen. Chem. U.S.S.R.* 29, 1627-31 (1955)(Engl. translation).—See *C.A.* 50, 8490c. H. M. B.

KABACHNIK, M.I.; MASTRYUKOVA, T.A.

Reactivity of alkali salts of dialkylthiophosphoric acids.  
Alkylation reactions. Zhur. ob. khim. 25 no.10:1924-1932  
S '55. (MLRA 9:2)

1. Institut elementeorganicheskikh soedineniy Akademii nauk  
SSSR.

(Alkylation) (Phosphorothioic)

*Kabachnik, M.*

~~Reaction of dialkyl dithiophosphates with ethylene oxide.  
M. I. Kabachnik, F. A. Maslyukova, and V. N. Olsuf  
Zh. Fiz. Khim. U.S.S.R. 25, 2241-4 (1951) (Eng.  
translation).—See C.A. 50, 9231b. E. M. R.~~

*103*

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Kobachnik M.I.

✓ Reaction of dialkyl dithiophosphates with ethylene oxide.  
 M. I. Kobachnik, T. A. Muzryukova, and V. N. Odintsov.  
~~Ukrainian Chemical Review, 1965, 35, 2274-7 (1965).~~ Zhur. Ob-  
 shchei Khim. 25, 2274-7 (1965). — Passage of ethylene oxide  
 into (RO)<sub>2</sub>PS<sub>2</sub>H with cooling to about 30° until the acid re-  
 action (litmus) is no longer present, gave after distn. in the  
 presence of a little benzotriazole, the following esters: (RO)<sub>2</sub>-  
 PS<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>OH (R, % yield, n<sub>D</sub><sup>20</sup>, d<sub>4</sub>, and b.p. shown): Et-  
 05, 1.5250, 1.2042, b<sub>D</sub> 110-50°; Pr, 08, 1.5110; 1.1410, b<sub>D</sub>  
 124-0°; iso-Pr, 50, 1.5083, 1.1323, b<sub>D</sub> 118.5-30°; iso-Bu,  
 03, 1.5045, 1.0965, b<sub>D</sub> 135-5°; Me, 100, undistillable, 1.5180,  
 1.2911. Treatment of some of these with Ac<sub>2</sub>O in pyridine  
 at 40-50° (final temp.) gave: 70% (EtO)<sub>2</sub>PS<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>OAc,  
 b<sub>D</sub> 135.5-8.5°, n<sub>D</sub><sup>20</sup> 1.5010, d<sub>4</sub> 1.1845; 71% (iso-BuO)<sub>2</sub>PS<sub>2</sub>-  
 CH<sub>2</sub>CH<sub>2</sub>OAc, b<sub>D</sub> 140-1°, 1.4890, 1.0648. To 30 g. (EtO)<sub>2</sub>-  
 PS<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>OH in CCl<sub>4</sub> was added 20 g. PCl<sub>5</sub> and the mixt.  
 stirred 1 hr. at 0°; after treatment with ice and washing  
 with Na<sub>2</sub>CO<sub>3</sub> there was obtained 5 g. (EtO)<sub>2</sub>PS<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>Cl,  
 b<sub>D</sub> 103-4°, n<sub>D</sub><sup>20</sup> 1.5230, d<sub>4</sub> 1.2270. If the reaction of ethyl-  
 ene oxide with the thiophosphates is run without temp. con-  
 trol, the products are undistillable viscous oils, probably  
 formed by further condensation of the oxide at the HO  
 group. Cf. U.S. 2,611,728, C.A. 47, 2830a. G. M. K.

RMK

MEDVED', T.Ya.; KARACHNIK, M.I.

Acylation of the aminoalkylphosphonic and aminoalkylthiophosphonic acids. Izv.AN SSSR.Otd.khim.nauk 86 no.6:1043-1047 My '55.(MLRA 9:4)

1.Institut elementoorganicheskikh soedineniy Akademii nauk SSSR.  
(Acylation) (Phosphonic acid)

MEDVED', T.Ya.; KABACHNIK, M.I.

Methylation of the  $\alpha$ -aminealkylphosphonic acids and their esters.  
Izv.AN SSSR Otd.khim.nauk 36 no.6:1048-1052 My '55. (MLRA 9:4)

1. Institut elementeorganicheskikh soedineniy Akademii nauk SSSR.  
(Methylation) (Phosphonic acid)

*Yehoshua M. I. ...*  
the extent of the shift could be made. Infrared spectroscopy

KABACHNIK, M.I.; GOLUBEVA, Ye.I.

Addition of sulfur to dialkyl phosphites. Dokl. AN SSSR 105  
no.6:1258-1261 D '55. (MIRA 9:4)

1.Chlen-korrespondent AN SSSR (for Kabachnik)  
(Phosphites) (Sulfur)

KABACHNIK, M. I.

"Tautomerism of Some Organophosphorous Compounds"  
paper presented at Nn First Conference on Phosphorous Compounds, Kazan,  
8-10 Dec 56

SO: B-3,084, 841

*KABA CHIN'CSH, M.I.*

180000  
Derivatives of a substituted phosphonic acid  
of a-mocyclohexyl phosphonic acid and their trans-  
forms. Y. V. Bida, and M. I. Kabatin. Inst. Chem.  
of the USSR Acad. Sci. Ser. Chem. 1967, 1:100

KABACHNIK, M.I., MASHRYUKOVA, T. A. and KURCHALIN, N.I.

O,O- and O,S-Dialkyl Alkylphosphonothioates.

Iz. Ak, Nauk SSSR. Otdel, Khim  
Nauk, No.2, 1956, pp 185

Translation 564938C

KABACHNIK, M.L.; MASTRYUKOVA, T.A.; KUROCHKIN, N.I.

Esters of alkylthienephosphinic and alkylthiophosphinic acids.  
Izv.AN SSSR Otd.khim.nauk no.2:193-198 P '56. (MLRA 9:7)

1.Institut elementoorganicheskikh soyedineniy Akademii nauk SSSR.  
(Phosphinic acid)

MEDVED', T.Ya.; KABACHNIK, M.I.

Acylation of aminoalkylphosphinic and aminoalkylthiophosphinic acids by chlorocarbonic esters. Izv.AN SSSR.Otd.khim.nauk no.3: 327-331 Mr '56. (MLRA 9:8)

1. Institut elementoorganicheskikh soyedineniy Akademii nauk SSSR. (Phosphinic acid) (Formic acid) (Acylation)

*Kabachnik, M. I.*

USSR/Organic Chemistry - Synthetic Organic Chemistry, E-2

Abst Journal: Referat Zhur - Khimiya, No 1, 1957, 958

Author: Mastryukova, T. A., Prilezhayeva, Ye. N., Uvarova, N. I., Shostakovskiy, M. F., and Kabachnik, M. I.

Institution: Academy of Sciences USSR

Title: On the Reaction of Dialkyldithiophosphates with Thiovinyl Ethers

Original

Periodical: Izv. AN SSSR, Section on Chemical Sciences, 1956, No 4, 443-450

Abstract: It is shown that  $(RO)_2PSSH$  (I) combines easily with  $CH_2 = CHSR'$  (II) in accordance with Markovinkoff's rule with the formation of  $(RO)_2PSSCH(CH_3)SR'$  (III). The following compounds of the type III have been prepared (R, R', the yield in percent, bp in °C/mm,  $n_D^{20}$ , and  $d_4^{20}$  are indicated in that order):  $C_2H_5, C_2H_5$  (IV), 70-75, 109-110/2.5, 1.5290, 1.1392;  $C_2H_5, C_4H_9$  (V), 66, 109-110/2, 1.5198, 1.0965;  $C_2H_5, C_4H_9OCH_2CH_2$ , 80, 123-125/3, 1.5125, 1.0940; iso- $C_4H_9, C_2H_5$ , 78, 113-115/2, 1.5070, 1.0556; iso- $C_4H_9, C_4H_9$ , 90, 121-122/2, 1.5052, 1.0384; iso- $C_4H_9, C_4H_9OCH_2CH_2$ , 60-80, 124-126/3, 1.5012,

Card 1/2

MEDVED', T.Ya.; KABACHNIK, M.L.

Derivatives of  $\alpha$ -aminoalkylphosphinic acids. Esters of  $\alpha$ -isocyanatoalkylphosphinic acids and their conversions. Izv. AN SSSR. Otd. khim. nauk no. 6:684-691 Je '56. (MIRA 9:9)

1. Institut elementoorganicheskikh soedineniy Akademii nauk SSSR.  
(Phosphinic acid)

KABACHNIK, M.I.; GILYAROV, V.A.

Imides of alkylphosphoric acids. Trialkyl-N-phenylimidophosphates.  
Izv.AN SSSR Otd.khim.nauk no.7:790-797 J1 '56. (MLRA 9:10)

1. Institut elementeorganicheskikh soedineniy Akademii nauk SSSR.  
(Phosphates)

KABACHNIK, M.I.; IOFFE, S.T.; SHYINKER, Yu.N.

Tautomerism of  $\alpha$ -pyridone and carbostyryl. Zhur.ob.khim. 26  
no.7:2025-2029 J1 '56. (MIRA 9:10)

I. Institut elementoorganicheskikh soedineniy Akademii nauk SSSR  
i Vsesoyuznyy nauchno-issledovatel'skiy khimiko-farmatsevticheskiy  
institut imeni S. Ordzhonikidze.  
(Pyridone) (Carbostyryl) (Isomerism)

KABACHNIK, M.I.

Some problems of tautomerism. M. I. Kabachnik  
Uspehi Khim. 25, 137-61(1956).—A  
duction is followed by a review summary of recent work on  
tautomerism of derivatives of thiophenol, and instances  
of lactam-lactim tautomerism. References  
through 1956 and early 1957. C. M. K. Kuznetsov

EM

Kabachnik, M. I.

USSR/Chemistry - Elementorganic compounds

Card 1/1 Pub. 124 - 3/28

Authors : Kabachnik, M. I., Memb. Corres., Acad. of Sc., USSR

Title : New methods for practical application of organoelemental compounds

Periodical : Vest. AN SSSR 26/1, 15-26, Jan 1956

Abstract : The role of organoelemental compounds in the development of modern chemistry is discussed. New methods for practical application of organoelemental compounds in science and industry are described. Names of Soviet and foreign chemists who greatly contributed to the development and application of organoelemental compounds are included. Seven USSR references (1946-1955).  
Diagrams.

Institution : .....

Submitted : .....

*KABACHNIK, M.I.*

KABACHNIK, M.I.; MASTRYUKOVA, T.A.; KUROCHKIN, N.I.; RODIONOVA, N.P.; POPOV,  
Ye.M.

Reactivity of alkali salts of alkylthiophosphinic acid esters.  
Alkylation and acylation. Zhur. ob. khim. 26 no.8:2228-2233 Ag '56.  
(MLRA 10:11)

1. Institut elementoorganicheskikh sovedineniy AN SSSR.  
(Phosphinic acid) (Alkylation)

Kabachnik, M.I.

HUNGARY/Organic Chemistry - Theoretical and General Questions  
on Organic Chemistry

E-1

Abs Jour : Referat Zhur - Khimiya, No 2, 1957, 4211

Author : Nesmeyanov, A.N., Kabachnik, M.I.

Title : Dual Reactivity and Tautomerism.

Orig Pub : Magyar kem. folyirat, 1956, 62, No 5, 177-184; No 6,  
212-216; No 7, 252-255; No 8, 281-287

Abstract : Translation from the Russian.  
See RZhKhim, 1955, 54952.

Card 1/1

- 2 -

KABACHNIK, M.I.; GILYAROV, V.A.

Imides of alkylphosphonic acids. Trialkylphosphate azines. Dokl.  
AN SSSR 106 no.3:473-475 Ja '56. (MLRA 9:6)

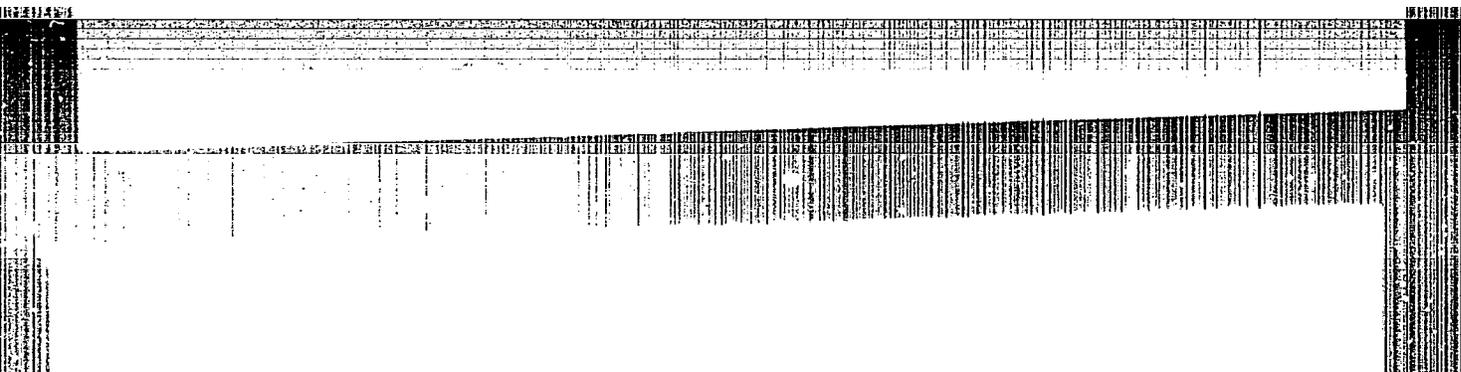
1.Chlen-korrespondent AN SSSR (for Kabachnik). 2.Institut elemente-  
organicheskikh soyedineniy Akademii nauk SSSR.  
(Azines)

MIKLUKHIN, G.P. [deceased]; SULIMA, L.V.; MASTRYUKOVA, T.A.; KABACHNIK, M.I.

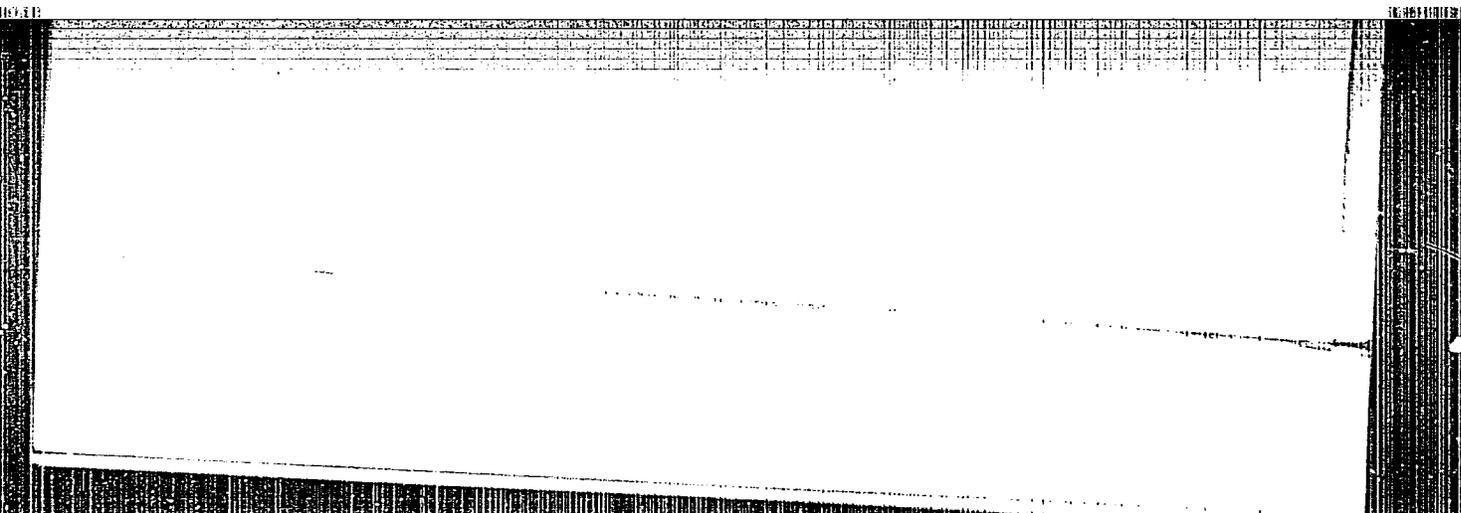
Mobility of sulfur in thiophosphorus-organic compounds. Trialkylthiophosphates and dialkylthiophosphates. Dokl. AN SSSR 106 no.5:848-850 F '56. (MIRA 9:7)

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